EFFECTIVE TEACHING PRACTICES

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ABSTRACT

This paper reports the overall findings of research on effective teaching practices in Wake County Public Schools (WCPSS). It is a cross-case analysis of five earlier studies (Biology, Algebra I, U.S. History, middle school Algebra I, and English I). Despite subject implementation differences, four common themes were found:

- *high academic expectations for all students,*
- *thoughtful management of time and materials,*
- *learning-centered classrooms, and*
- *proactive planning.*

INTRODUCTION

From 2004 to 2009, the Evaluation and Research Department (E&R) of the Wake County Public School System (WCPSS) in collaboration with the Curriculum and Instruction Department (C&I) conducted five studies of effective teaching practices:

- Biology (Haynie, 2006),
- Algebra I (Haynie & Kellogg, 2008),
- U.S. History (Haynie & Stephanie, 2008),
- Middle School Algebra I (Haynie, 2009), and
- English I (Haynie, Merritt, & Bowen, 2010).

The series of studies above is completed, and this report synthesizes the results, identifying overall effective teaching practices and targets for systematic improvement.

These research studies had two main objectives:

- Study each subject, using a WCPSS Value-Added Instructional Improvement Analysis Model.
  - ► Collect WCPSS-specific data that will help teachers, school, and district leadership understand the current instructional practices in each subject.
  - ► Identify and share best teaching strategies in each subject that are linked to high student achievement.

- Contribute to a series of studies that identify targets for overall systemic improvement.
  - ► Identify the roles of teachers, academic departments, principals, schools, and central services' administrators in the school improvement process.
  - ► Identify the practices of effective instruction.

The methodology used in this research has been described in detail in each of the five individual reports. It is also described in Appendix A of this report for the convenience of the reader.

Results were organized, analyzed, and reported slightly differently in each study, reflecting both a learning evolution as each report built on the one before and subject-specific differences. Despite these reporting differences, many common themes of effective teaching practices emerged. These themes can be organized into four main categories:

- high academic expectations for all students,
- thoughtful management of time and materials,
- learning-centered classrooms, and
- proactive planning.

Each category is supported with examples from each of the five reports. A summary of how these categories are supported by data from each study is in Table 1. Each theme is described in detail by subject in this report on the pages indicated in Table 1. For more details, see the original reports at:

- Effective Biology Teaching: A Value Added Instructional Improvement Analysis Model:
  (http://www.wcpss.net/evaluation-research/reports/2006/0528biology.pdf)

- Improving Student Success in High School Algebra I by Identifying Successful Teachers and Schools:
  (http://www.wcpss.net/evaluation-research/reports/2008/0610algebra_full_study.pdf)

- Effective Teaching Practices in U.S. History
  (http://www.wcpss.net/evaluation-research/reports/2008/0705effective_us_history.pdf)

- Middle School Algebra I: Effective Instructional Strategies with Comparison to High School Practices:
  (http://www.wcpss.net/evaluation-research/reports/2009/0831ms_alg1.pdf)

- Effective Teaching Practices in English I:
  (http://www.wcpss.net/evaluation-research/reports/2010/0906eng1.pdf)

Table 1
Common Generic Themes with Best Practices by Subject

Subject	High Academic Expectations for All Students *pages 9-14*	Thoughtful Management of Time and Materials *pages 14-19*	Learning-Centered Classrooms *pages 20-24*	Proactive Planning *pages 25-28*
Biology	► Teachers focused on North Carolina Standard Course of Study. ► Teachers held frequent communication with students on progress toward goals.	► Teachers resisted distractions that pulled them away from students. ► Most class-time was spent on teacher-controlled activities, mostly lecture and teacher-directed labs. ► Teachers used a common pacing guide, data-driven decisions, and designed a "year at a glance" document.	► Teachers gave frequent assessments. ► Teachers held EOC review sessions by selected content. ► Teachers were accessible to students for extra help.	► Teachers planned with other teachers. ► Teachers developed their own pacing guide and common assessments. ► Teachers collected their own data. ► Teachers planned their own activities.
Algebra I	► Teachers used spiraled curriculum with 68% of time on new material daily. ► Teachers emphasized problem solving over rote memorization. ► Explanations by teachers were more concept-driven than skill-driven.	► Teachers taught bell to bell. ► There were schoolwide plans for use of time and materials. ► Teachers wrote their own pacing guides. ► There were guidelines for use of textbooks and calculators.	► Teachers created a classroom culture in which all students were free to ask questions, contribute, or offer explanations. ► Teachers used sustained feedback and gave meaning to homework.	► Teachers planned with other teachers and developed their own pacing guide. ► Teachers prepared all course materials before the start of school. ► Schools had a support structure for teachers, including new teachers.
U. S. History	► Teachers taught reading and note-taking in history daily. ► Teachers used higher-order thinking-skill questions and themes. ► Teachers placed acquisition of facts within a sense-making context.	► Teachers maximized time on block schedule. ► Teachers controlled all students' activities. ► Teachers used lecture/discussion mostly. ► Teachers focused all student time on curricular activities.	► Teachers made connections to current events and to students' lives. ► Teachers facilitated the use of student imaginations to connect into historical settings. ► Teachers made student-affirming comments. ► There was no time for teacher-centered comments.	► Teachers prepared student guides, graphic organizers, warm-up questions, and many other supplementary teaching aids. ► Teachers planned with other teachers, focusing on concepts and strategies.
English I	► Teachers assigned work at the application and analysis levels regularly. ► Teachers allowed opportunities for critical response.	► All classroom time was well-managed. ► Students engaged in listening and speaking tasks with little in-class reading.	► Teachers used Marzano research-based strategies. ► Teachers taught communication, reading, and study skills in preparation for success in all high school courses and in life after high school.	► The teachers were comfortable with the North Carolina Standard Course of Study and were strategic in their approach to teaching it. ► Teachers connected class instruction to the English I EOC exam.
Middle School Algebra I	► Top teachers held a significantly higher expectation for all students than did bottom teachers. ► Rigorous and challenging tasks were assigned to all students for all of class periods. ► Appropriate mathematical vocabulary was used by teachers and students.	► There was little lecture, more whole-group discussion and small groups. ► There was structured classroom management that facilitated student ownership of learning. ► Teachers used frequent formative assessment to adjust instruction.	► Teachers allowed inquiry, wrong answers, personal challenge, collaboration, and disequilibrium. ► Teachers and students were willing to risk being wrong. ► Teachers taught students to be mathematicians. ► Teachers listened carefully and used frequent formative assessment.	► Teachers used shared planning time to create lesson plans that progressed linearly through the curriculum. ► Teachers used WCPSS pacing guide. ► Teachers ranked "basics" as the least important topic in their Algebra I class.

IMPORTANCE OF TEACHER QUALITY

Several studies of student gains on standardized tests from one year to another have found a student's assigned teacher to be the most influential factor (Rivkin, Hanushek, & Kain, 2001; Sanders & Horn, 1994; Sanders & Rivers, 1996; Wright, Horn, & Sanders, 1997). The Elementary and Secondary Education Act of 1965 (ESEA), as amended by the No Child Left Behind Act of 2001 (NCLB), also includes sections concerning teacher quality (U.S. Congress, 2001). Under NCLB, every state must develop and implement a plan to ensure that all students will be taught by a "highly qualified teacher" (HQT; sec. 2101). The NCLB law (U.S. Department of Education, 2006) uses three key guidelines to determine whether a teacher is highly qualified:

- at least a bachelor's degree in the subject taught,
- full state teacher certification, and
- demonstrated knowledge in the subject taught.

The importance of teachers is also recognized by national subject-specific professional teaching organizations. National teaching standards have been written for each of the core subject areas. In the National Science Education Standards, chapter four is devoted to the standards for the professional development of teachers. Professional Development Standard C gives a list of musts for professional development activities. Among the list are "Provide opportunities for teachers to receive feedback about their teaching and to understand, analyze, and apply that feedback to improve their practice" (National Research Council, 1996).

The National Council of Teachers of Mathematics (NCTM) in *Principals and Standards for School Mathematics* details requirements of effective teaching, including the requirement to continually seek improvement. "The improvement of mathematics education for all students requires effective mathematics teaching in all classrooms" (National Council of Teachers of Mathematics, Inc. [NCTM], 2000, p. 17).

In the field of social studies, *The National Standards for Social Studies Teachers* (National Council for the Social Studies [NCSS], 2002) is primarily a document devoted to setting forth subject-matter standards. The standards for delivering "Powerful Social Studies" are defined using five principles of teaching and learning. These principles are that teaching should be meaningful, integrative, value-based, challenging, and active.

Langer, Close, Angelis, and Preller (2000) reported research conducted in 44 English classrooms in 25 schools in 4 states that identified six practices used in the top-performing schools. These practices are presented as guidelines for teaching students to read and write well. For all six guidelines, the teacher is the key to facilitating each practice. Three are stated as teacher behaviors:

- integrating test preparation into instruction,
- making connections across instruction, curriculum, and life, and
- fostering cognitive collaboration.

Three are stated as student goals:

- learning skills and knowledge in multiple lesson types,
- learning strategies for doing the work, and
- being generative thinkers.

Over the past twenty years, the importance of the classroom teacher has emerged as a key component of school reform. In 1987, the National Board for Professional Teaching Standards was established with a mission of advancing the quality of learning by advancing the quality of teaching. In 1989, the National Board issued a policy statement, *What Teachers Should Know and Be Able to Do* (National Board for Professional Teaching Standards [NBPTS], 1989), which posited five core propositions to guide the certification of National Board Teachers:

- commitment to students and learning,
- knowledge of the subject taught and effective methods of teaching it,
- responsibility for managing and monitoring student learning,
- systematic reflection on practice that leads to improved practice, and
- membership in a learning community.

IMPORTANCE OF STUDYING WCPSS TEACHER PRACTICES

In North Carolina, End-of-Course (EOC) exams are administered in eight high school courses. Each exam is a standardized multiple-choice test written with input from teachers across the state. Teachers participate in test development in a variety of ways, from writing the curriculum on which EOC tests are based, to writing and reviewing test items. Each student who takes an EOC test is assigned a scale score based on the number of items correct and the difficulty of items. The scale scores are then converted to one of four levels of performance. Levels III and IV are associated with adequate or higher mastery of course content, and are considered proficient (North Carolina Department of Public instruction [NCDPI], 2009).

Teachers receive rosters of students' scale scores, level scores, and a 100-point scale score that is averaged as 25% of the final class grade. An average scale score for the class is also reported on each roster. The percentages of students passing each EOC in a school are reported publicly. Teachers judge their own success using these percentages. The scores can also be disaggregated into many subgroups (e.g., students with disabilities [SWD], limited English proficient students [LEP], academically gifted students [AG], etc.).

For high schools, the EOC tests administered each year are a large component of the ABCs of Public Education, the state's accountability program. The program has two standards of achievement: the absolute percentage of tests at or above grade-level proficiency, and the attainment of "expected" growth. The basic assumption of the growth part of the model is that a student should be expected to do at least as well, on each EOC test as prior performance on End-of-Grade (EOG) and EOC tests would suggest, compared to all other students who took the test in the standard-setting year. The standard-setting year is typically the first year that a test becomes operational. Each student who is tested and has previous test results is assigned an "academic change" value. A positive academic change indicates sufficient academic progress, while a negative value indicates insufficient academic progress. The average of all students'

academic change values, across all EOCs, is calculated by the state's accountability program. If the average is zero or higher, the school makes "expected growth." Teachers and schools with academically weaker students can still make expected growth regardless of the level performance of students. Teachers with high-achieving students do not always produce expected growth in their students. The expected growth measure is considered by many teachers to be a fairer measure of success than student proficiency alone, because it takes into account the skill set that students bring to the course (NCDPI, 2009).

All EOC test results are combined into a Performance Composite for each school, and a "high growth" measure is also reported for each school. A school is said to make "high growth" if 60% or more of the "academic change" values are positive across all tests. In 2008-09, the proficiency of all WCPSS high school students tested was 79.6%. The performance of subgroups ranged from 55.7% to 90.8% (Figure 1).

Figure 1
2008-09 WCPSS High School Proficiency by Subgroup
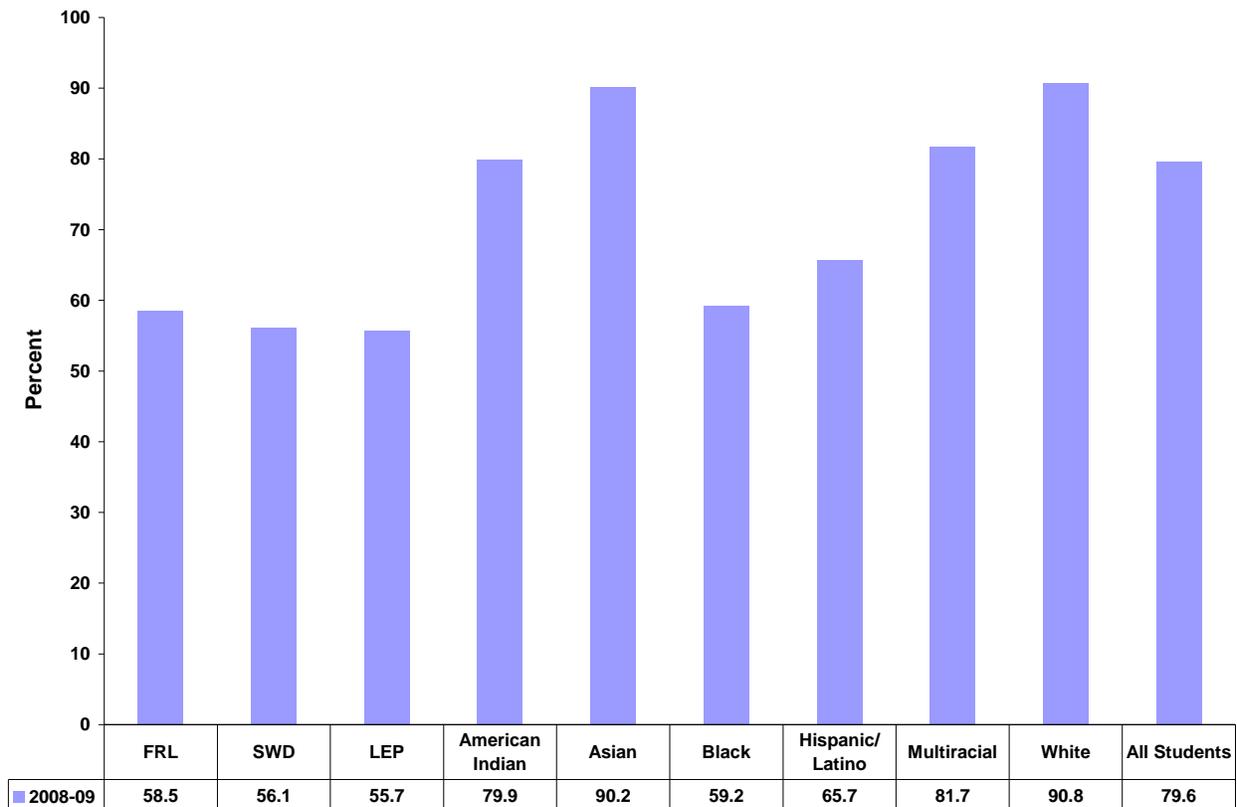
|	FRL	SWD	LEP	American Indian	Asian	Black	Hispanic/ Latino	Multiracial	White	All Students
■ 2008-09	58.5	56.1	55.7	79.9	90.2	59.2	65.7	81.7	90.8	79.6

Data Source: WCPSS high school ABCs 2008-09 Charts as of August 6, 2009
Interpretation Example: 58.5% of free or reduced-price lunch (FRL) students scored a Level III or IV on their EOC exams.

Ten of 23 WCPSS high schools made "high growth" in 2008-09. The percentage of students with positive "academic change" was 55.5% overall and ranged from 49.3% to 65.9% by subgroup (Figure 2).

Figure 2
2008-09 WCPSS High School "High Growth" by Subgroup
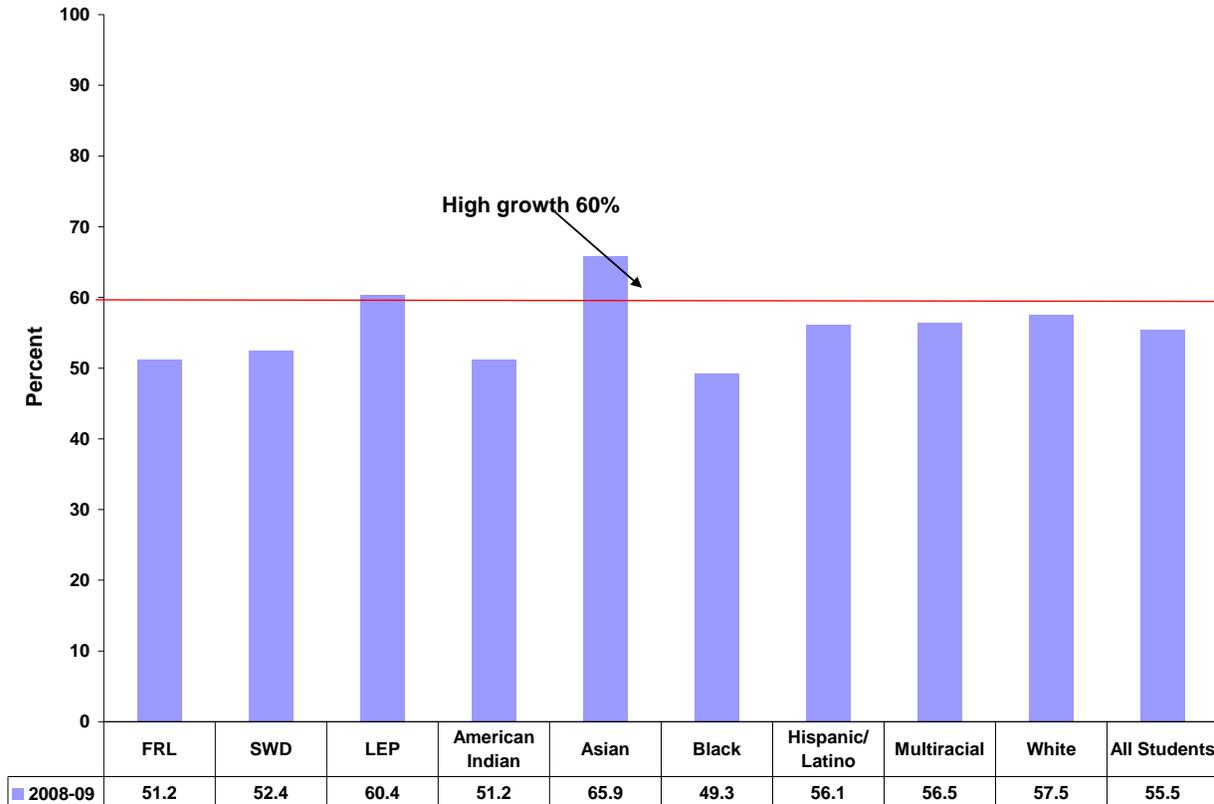
	FRL	SWD	LEP	American Indian	Asian	Black	Hispanic/ Latino	Multiracial	White	All Students
2008-09	51.2	52.4	60.4	51.2	65.9	49.3	56.1	56.5	57.5	55.5

Data Source: WCPSS high school ABCs 2008-09 Charts as of August 6, 2009
Interpretation Example: 51.2% of FRL students had positive "academic change" scores.

Improving teacher practice is crucial if WCPSS is to reach the Board of Education goal that all students will demonstrate high academic growth. The five studies summarized in this paper identified teaching practices of the most effective WCPSS teachers. Having district-specific examples of best practice puts a local face on the national standards and supports the importance of striving to practice the standards in WCPSS.

The classroom practices of the most successful teachers can be documented to give hope to teachers struggling with low performers and to challenge teachers of high performers to even higher academic goals. The school-wide practices of successful schools, identified in these studies, can also serve as models for school improvement efforts. Teacher performance evaluation was not a goal of the studies, unlike most current valued-added models (Braun, 2005; Olson, 2005; Olson, 2004a, 2004b; Sanders, 1998; Tucker & Stronge, 2005). These studies demonstrate the use of value-added research for teacher and school improvement rather than for purposes of teacher evaluation.

SUBJECTS

In each study, teacher identification began with current teachers who had taught the subject for the three consecutive years prior to the study year. It was assumed that more data would produce more accurate and stable results. The number of teachers that met this criterion was about 30% of the total teacher pool in each subject:

- Biology: 43 teachers,
- Algebra I: 41 teachers,
- U.S. History: 29 teachers,
- Middle School Algebra I: 36 teachers, and
- English I: 42 teachers.

For each identified teacher, an average student residual was calculated across all years and classes. See Appendix A for details of the residual analysis. Teachers were ranked on effectiveness from highest average to lowest. In each study, 7 to 10 teachers were labeled as "top teachers" and an equal number as "bottom teachers." These teachers became the focus of analysis (Table 2).

Table 2
Teachers in the Studies

Subject	# of Top Teachers	# of Bottom Teachers	Years of Data Collection
Biology	10	10	2001-2005
Algebra I	9	9	2002-2006
U.S. History	10	10	2001-2007*
English I	7	7	2004-2008
Middle School Algebra I	8	8	2003-2007

* No test data available in 2003-04 and 2004-05

Note that the residual analysis was also used to rank schools on effectiveness in WCPSS. School focus group interviews were conducted in the Algebra I, U.S. History, and the English I studies.

RESULTS

While the observable practices of effective teachers may vary from classroom to classroom the categories of practice are universal. The common themes were divided into four categories:

- high academic expectations for all students,
- thoughtful management of time and resources,
- learning-centered classrooms, and
- proactive planning.

Examples from each study are given here to illustrate the theme in practice.

HIGH ACADEMIC EXPECTATIONS FOR ALL STUDENTS

Four of the five studies (and one by implication) specifically reported that high academic expectations for students are held by the top teachers. These expectations were closely related to teachers holding a positive attitude about students' work ethic, willingness, and ability to learn.

Biology

In the biology study it was found that top teachers focused all student time on the North Carolina Standard Course of Study (NCSCS) goals and communicated to students their progress on these state standards. This implies that these teachers held high academic standards for all their students.

Algebra I

Responses on surveys and in focus-group interviews showed that top teachers believed that their students could succeed. Top Algebra I teachers created a classroom culture in which all students were free to ask questions, contribute, or offer explanations. They emphasized problem solving over rote memorization. One of the key differences observed during classroom visits was the use of class time; top Algebra I teachers spent much more time on average on new material than did less effective teachers.

Responses during Algebra I focus-group interviews gave teachers' rationales behind the use of classroom time. The bottom teachers felt that they could not go into new material without first reteaching the prerequisite skills. They viewed Algebra I as a fixed linear progression. This attitude often led to a negative classroom atmosphere in which students felt inadequate and defeated. The students were bored with the old material and had accepted that they could not do any better. On the other hand, top Algebra I teachers believed that they could remediate prerequisites within a spiraled curriculum that introduced new material daily. Table 3 summarizes the observations about use of time.

Table 3
Algebra I Teachers: Classroom Use of Time

Content	Top Teachers	Bottom Teachers
Old Material	22%	36%
New Material	68%	36%
Wrap-up	10%	28%

Four of the six top teachers were observed using explanations that were more concept-driven than skill-driven. They emphasized the "why" behind processes and indicated strategies for approaching the problem instead of memorizing step-by-step algorithms. None of the five bottom teachers were observed explaining concepts and emphasizing processes. Top Algebra I teachers were able to create a positive classroom culture with a positive attitude toward student ability to perform well.

U.S. History

During U.S. History teacher focus-group interviews, both top and bottom teachers stated that students generally did not know how to read the U.S. History textbook or other supplementary materials. The teachers also voiced concern over the note-taking skills of their students. On the survey, six top teachers agreed with the statement, "My students have strong prerequisite skills," while nine bottom teachers disagreed with this statement. Follow-up focus-group interviews elucidated the difference between survey responses and interview responses. Top teachers believed that students had the ability to learn to read the history materials, and that they could teach them to do so. Bottom teachers believed that it was the student's responsibility to read, and they did not have time to teach reading. The same basic attitude was held about note taking.

U.S. History top teachers spent time early in the class discussing the organization of history texts. They assigned reading and quizzed students before discussing the reading. They partnered with parents to encourage the importance of taking the readings seriously. Top teachers provided a clear note-taking structure for students. This structure varied from teacher to teacher, but top teachers held all students accountable for their notes. One teacher was observed telling students to write in their "Presidents" section. The notes were organized in ways that held students responsible for all the history that they have studied, and so aided in preparation for cumulative questions.

The teaching of reading and note taking in history was a daily activity in the classes of top teachers, but missing from most of the classes of bottom teachers. In Advanced Placement U.S. History, data-based questions (DBQs) were part of the course expectations. One top teacher was observed sharing a teacher-written DBQ writing as a model for the students to follow. This teacher displayed confidence in the students' abilities to learn to write at a high level, but took the responsibility to model and thus teach this skill.

Since top U.S. History teachers held a more positive attitude concerning what students could be taught in their classes, it was no surprise that they were observed using higher-order questions about connections and themes. In top-teacher classrooms, all students were called upon by name to participate and were kept engaged throughout the class period. The teachers placed the acquisition of facts within a sense-making context. The use of political cartoons and short video clips was observed. All top teachers were observed using higher-order questions. Only two bottom teachers were observed using higher-order questions, and these two teachers did not question all students (some students were allowed to not participate). The other eight bottom teachers were observed using lower-order, fact-driven questions, and the amount of questioning was limited. There was much more teacher talk and much less student participation in bottom-teacher classes.

One result from the U.S. History teacher survey may help explain why bottom teachers used mostly lower-level questioning and more teacher talk. When asked how planning time was spent, 7 of 10 bottom teachers responded that pacing was their first concern, while only one top teacher did so. The other top teachers chose concepts or strategies as their responses. If pacing equates to concern for covering all the material, then bottom teachers may have believed that they did not have time to let students participate and explore more thought-provoking questions.

English I

During the English I classroom observations, the level of student work assigned was classified by the observers. The protocol for classifying level of student work came from the Teachscape (2007) "Standard Look-fors" tool. There are six levels.

- Recalling information (knowledge).
- Understanding information (comprehension).
- Using information in a new way (application).
- Breaking down information into parts (analysis).
- Putting information together in new ways (synthesis).
- Making judgments and justifying positions (evaluation).

Because the differences between these levels are subtle and challenging to note in the midst of an observation, the researchers combined some levels to indicate that work seemed to be at the "low," "middle," or "high" end of the continuum of types of thinking. Knowledge and comprehension were identified as "low," application and analysis were identified as "middle," and synthesis and evaluation were identified as "high." It is not assumed that "low" means that the kind of thinking or work is easy. However, it does imply that fewer processes might have to be in play in order for this type of thinking to occur or work to be produced. Moreover, if students are only required to perform at "low," they miss out on opportunities for critical response.

There were some differences in the level of student work observed between the students of English I teachers in the top group and students of English I teachers in the bottom group. In the top group of teachers, while students of all the teachers did some work at the "low" level, all of the teachers also had students performing work at the "middle" level, and two of the teachers had students whose work moved into the "high" level. In the bottom group during every observation, students completed work at the "low" level, but only two teachers were observed having students perform work at the "middle" level. One bottom teacher also had students who performed some work at the "high" level (Table 4).

Table 4
Level of English I Student Work Observed

Group	Low Level Thinking Tasks	Middle Level Thinking Tasks	High Level Thinking Tasks
Top	7 out of 7	7 out of 7	2 out of 7
Bottom	6 out of 6	2 out of 6	1 out of 6

Interpretation Example: 7 top teachers out of 7 were observed using middle level thinking tasks, while only 2 bottom teachers out of 6 were observed using middle level thinking tasks.

Middle School Algebra I

All middle school Algebra I teachers had a positive attitude overall toward their students and their teaching assignment; yet top middle school teachers were significantly more positive than bottom middle school teachers. Both the high school and middle school teacher surveys contained Likert scale statements that measured teacher attitude toward students. The responses were converted to a one to four scale from one for "strongly disagree" to four for "strongly agree." A test of significance found that the middle school top teachers' mean responses compared to middle school bottom teachers' mean responses were all significantly higher (showing stronger agreement) for every statement but one. All of the top teacher means were above a 3.0, ranging from 3.38 to 4.00. The bottom teacher means ranged from 2.63 to 3.38, with two means below a 3.0. The two areas with means below a 3.0 were for the statements that "my students have strong prerequisite skills" and "my students work hard." In looking at these results compared to those of the high school Algebra I study, it is also of interest to observe that the bottom middle school teachers' attitude means were only significantly higher than two means of the top high school teachers ("My students set high standards" and "My students seek to understand concepts," and two means of the bottom high school teachers ("My students set high standards" and "My students have strong prerequisite skills"). Top middle school teacher means were significantly higher than all high school teacher means (Figure 3).

Figure 3
Mean Responses to Attitude Toward Student Statements

	My students work hard	My students do their homework	My students seek extra help	My students set high standards	My students have strong prerequisite skills	My students seek to understand
Top Middle School Teachers	3.75	3.75	3.88	4.00	3.38	3.75
Bottom Middle School Teachers	2.75	3.13	3.38	3.13	2.63	3.13
Top High School Teachers	2.78	3.00	2.89	2.44	2.22	2.22
Bottom High School Teachers	2.89	2.78	2.78	2.33	1.67	2.67

*significantly higher than all other teacher subgroups
**significantly higher than high school teacher subgroups

Green (2005) in his book *Expectations: How Teacher Expectations Can Increase Student Achievement and Assist in Closing the Achievement Gap* discussed at length what research says about the correlation between teacher expectations and student achievement. The contrast between observations and the survey attitude items of the top and bottom middle school teachers provided support in WCPSS of this research finding. Many educators and parents assume that middle school algebra students are the brightest and best. The top and bottom teachers of this study concurred; they were proud to teach such a high level course in middle school. Yet top teachers in this study held a significantly higher expectation for **all** their students than did the bottom teachers. During observations it was clear that students understood this expectation and had made it their own. The students of the top teachers fared better in terms of achievement during their year in Algebra I as measured by the EOC. A cohort study of high school mathematics course-taking patterns of students implied that they also rose to higher challenges later on in high school (Haynie, 2009).

Observing all middle school Algebra I students on task all of the class period—in tasks that were rigorous and challenging—was taken as an indicator of high expectations for all students. One top teacher challenged the class to use their own mental mathematics thinking by saying, "You're not going to make me write all the steps." Another teacher was heard to say, "I'm being mean making you spell math terms, right?" The teacher identified in the middle school Algebra I study as the most effective, who had 36% Black/African-American or Hispanic/Latino students, expressed amazement that other teachers had so little minority representation in classes. This teacher was observed including all students equally in class.

The vocabulary used by top teachers and their students was appropriate for mathematical discussions. Top teachers had students study definitions of terms. One teacher had a word wall prominently displayed in the classroom. Top teachers pointed out the assumptions of properties and the restrictions on operations. Students were required to understand terms such as "integer," "radical," "nonnegative," etc., and to be able to use assumptions and restrictions. Top teachers had students read their math book, which led to use of proper terms in classroom discussions such as "leading coefficient," "maximum and minimum of a quadratic function," "denominator," "exponent," "base," and "radical sign."

There was anecdotal evidence of mixed expectations of students in seven of eight bottom teachers' classes. Some students were allowed to be off-task. Some were observed reading other books, having their heads down on desks, talking off-task, and obviously day-dreaming. One bottom teacher expressed annoyance toward a student's question. On asking for volunteers to do an exercise, this same teacher ignored this student's offer to do the exercise. Some teachers were observed giving praise to some students, but not to others. In another class, a student was retesting during class time, thus missing the current lesson. A bottom teacher, annoyed by off-task questions by one student, answered the question, "Why do we have to take Geometry?" by replying, "then suffer through it and never take Geometry again." The question was off-task, but the "shut-up" answer set very low standards for the students. It validated the opinion that mathematics is a dreaded, required course for many students.

Bottom middle school Algebra I teachers were distracted by the students who were misplaced and lacked the math prerequisites or the study skills necessary for highest performance. Top

teachers focused on the positive qualities of each student, expecting all students to rise to their high expectations.

Summary of High Academic Expectations

Top teachers in all of the studies were observed setting high academic expectations for all students in their classrooms. In most cases, the top teachers held positive attitudes concerning the ability of their students to learn how to be successful. These top teachers exhibited the characteristics of proactive teachers as defined by Brophy and Good (1974). Top teachers were in control of their interactions with students. They had structured classes that maximized the achievement of students. The Brophy and Good categories "reactive" or "overactive" describe the bottom teachers. Student behavior controlled much of the interaction in the classroom. In the classrooms of overactive teachers, students are treated differently based on performance and behavior, and teachers are more likely to give up on students with poor performance or off-task behaviors. These overactive teacher behaviors were observed often in the classrooms of bottom teachers.

Most bottom teachers were observed using lower-level thinking questions and tasks predominately. Bottom teachers who used higher-order questioning did not demand full on-task attention by all students for the entire period. Students who chose not to attempt the questions were allowed to abstain from participation. In contrast, top teachers tended to demand full attention of all students for the entire class period. High expectations include both the expectation of a high level of thinking and the expectation of focused attention to the thinking by all students.

THOUGHTFUL MANAGEMENT OF TIME AND MATERIALS

Thoughtful use of time and materials by most effective teachers and/or schools was reported as a finding in all five studies. Top teachers and schools carefully planned the use of time in light of the subject area, student learning style, and current research. The use of time was regularly reevaluated based on results of formative assessments and peer reflection.

Biology

The WCPSS science curriculum specialist conducted observations in the classes of the most and least effective biology teachers. His overall observations of the most effective teachers supported survey results that the top teachers carefully planned their use of time and materials. They resisted distractions that pulled them away from contact with students. The predominant teaching mode used a combination of lecture and teacher-directed labs.

While the term "lecture" may cover a variety of activities, it seems clear that the top biology teachers exercised more control over time use and student attention than did bottom biology teachers. These teachers tended to spend more time on teacher-controlled activities but relatively less class time on projects, partner work, and small-group discussion.

The findings of the biology study concerning teacher directed use of time in alignment with a curricular focus has been supported by many earlier research studies (Anderson & Walberg, 1994; Frederick, 1980; Frederick & Walberg, 1980; Walberg, 1999; Walberg & Frederick, 1992). The predominant use of direct teaching as an effective tool in promoting student learning is also well documented in the research (Gage & Needles, 1989; Walberg, 1999; Wang, Haertel, & Walberg, 1993a, 1993b).

There were three overall findings of most effective biology teacher behavior related to time and material management. Top teachers worked on and used a common pacing guide, made data driven decisions about which goals and objectives to stress, and designed a "year at a glance" document.

Algebra I

The thoughtful use of time and materials was also observed in classrooms of top Algebra I teachers. Among top teachers, there was an urgency to teach from bell to bell. Top teachers used opening questions and exercises to quickly review past skills and serve as advanced organizers for new material. Top teachers watched time carefully, using the bulk of the period on new material, yet leaving the final five to nine minutes for a wrap-up. Bottom teachers were observed using the majority of their time on old material and wrap-up. One bottom teacher was observed allowing students 20 minutes at the beginning to check homework answers with a key on the overhead projector, and then, after an interesting 50 minute lesson, the class spent the last 20 minutes copying the next homework assignment. Despite the interesting lesson there was much off-task behavior at the beginning and end of class.

Focus-group interviews at the two most effective schools found that both schools had school wide plans for the use of time and materials in Algebra I. Both top schools prepared complete course materials during the summer prior to the first year of implementation of a new revised version of the NCSCS for Algebra I. Both schools wrote their own pacing guides using the district pacing guide as a model. At one top school, the schoolwide plan was for all Algebra I teachers to use the same daily homework assignments. At the other top school, a commercial curriculum with a book and supplemental materials was used, but the pacing guide was a school-prepared one and many additional lessons were written in order to fully address the NCSCS, especially the technology requirements. Both schools had spiraled curriculum that remediated weak prerequisite skills within the new material. Both schools emphasized problem solving and processes.

Both top schools used materials thoughtfully. The school that had common homework assignments used a textbook as a reference. The teachers said that the NCSCS was the curriculum, not the textbook. The teachers at this school were also emphatic about using teacher-made tests, not tests supplied with the book. The teachers at the other school felt that many of the prepared tests supplied with their book were appropriate to use, but they had selected the text carefully. Both schools withheld calculator use at the beginning of their courses; they wanted to build confidence in basic skills first, and introduced the calculator as a tool that supplements, but does not replace, human thought.

U.S. History

Both top and bottom U.S. History teachers expressed concern about block scheduling and how it provides less class time than the previously used full-year schedule (all WCPSS high schools are on a block schedule except one). While many bottom teachers struggled to maximize the block schedule time, top teachers exhibited stronger time management skills. They taught bell-to-bell using an invigorated delivery rate. They reflected the NBPTS core proposition number 3, "Teachers are responsible for managing and monitoring student learning," which includes "to make the most effective use of time." (NBPTS, 1989, p. 3). Top teachers engaged students in invigorating activities that included teacher and student talk. Although the second most effective teacher believed that 70% of class time was spent in lecture, the lecture was so captivating that there were not enough desks to seat all the students registered for the class. One student brought a lawn chair so he would have a seat. Even during the last period of the day, students were "on the edge of their seats," and attentive so they would not miss a word and be prepared to participate. The main mode of delivery observed in top U.S. History classes was this combination lecture/discussion method.

In contrast, observations of bottom teachers' classes found many students off-task and not engaged. Students were observed sleeping, yawning, and talking off task. Some students tried to participate, but were ignored as teachers continued to talk. Students spent time waiting for other students to finish tasks, listening to one student being chastised, listening to teacher complaints of student behavior, and waiting for a teacher to help a student returning from an absence.

Top teachers carefully controlled all student activities. They did not allow students to spend time on noncurricular activities or to spend excessive time on one aspect of the curriculum. Projects were used sparingly, if at all, by top teachers.

English I

All English I classrooms observed were well-managed. The difference between top and bottom teachers' time management was in the task selection and teaching method used. Classroom observations were used to identify level of classroom engagement. The protocol for identifying level of class engagement came from Teachscape's (2007) tool for "Standard Look-fors" when conducting walkthroughs. There are three levels:

- Highly engaged: Most students are authentically engaged.
- Well managed: Students are willingly compliant, ritually engaged.
- Dysfunctional: Many students actively reject the assigned task or substitute another activity.

During data analysis, researchers examined the level of engagement given for each episode coded during each classroom observation. The most common code given for episodes was "well managed." For teachers in the top group, all episodes were coded as at least "well managed" with the exception of one teacher. Most episodes were coded as "well managed" for teachers in the bottom group with the exception of some episodes for three teachers. However, the most noticeable difference was that two top teachers had either two or three episodes coded as "highly

engaged." In contrast, no teachers in the bottom group had episodes which were coded "highly engaged" (Table 5).

Table 5
Level of Engagement Observed in English I Classrooms

Group	Dysfunctional	Well Managed	Highly Engaged
Top	1 out of 7	7 out of 7	2 out of 7
Bottom	3 out of 6	6 out of 6	0 out of 6

Interpretation Example: 1 top teacher out of 7 had at least one episode coded dysfunctional, while 3 bottom teachers out of 6 had at least one episode coded dysfunctional.

Examples of episodes coded as "well managed" in the classrooms of the top teachers were found in field notes.

- "Teacher turns on CD player. Students are quiet; most students write at least once while the song plays."
- "Teacher tells students that they have two minutes to come up with the best example of the following four terms (simile, personification, alliteration, and metaphor) that they can in the last two minutes. Students are writing."
- "Students are in their groups. Both teachers are at the two groups. The other teacher, in her group, asks what we know about how a sentence starts. A student says, "Capital letter." Teacher says, "Okay, who has a capital letter?""

The "well managed" episodes provide evidence of, at minimum, ritualistic compliance and, at most, student participation. Episodes identified as being "highly engaged," on the other hand, demonstrate a level of student contribution to learning that is lacking in the "well managed" episodes. For example, in one class with three out of six episodes (consisting of 67 of the 85 minutes of the block) being identified as "highly engaged," students made intellectual contributions to the class by challenging positions held by their peers, making statements about the text which provided evidence of analysis, synthesis, and evaluation level, and responding to questions at those levels. Likewise, on seven separate occasions, students who were in the "outer circle" of the conversation voluntarily came to the "hot seat" or sent a note to the teacher in order to be allowed to participate in the discussion, and student comments frequently led to an extension of the conversation.

In one example, students were engaged in a seminar on *To Kill a Mockingbird* (Lee, 1982). Seated in a circle with his students, the teacher posed an initial question. Then a student asked the teacher if they could move from this question—in which they each came up with another title for the novel—to a different topic. In response to one of the titles raised by another student, she said that Atticus raised Jem well but felt that he tried to "rush her maturity" (referring to Scout) and that even though the line on the cover of the book calls this a "timeless classic of growing up," it is not a typical way of growing up. This comment, and a change in the direction of the discussion, led to a conversation about facing challenges, rushing children to grow up, and the degree to which Atticus is an effective parent. This eventually led to a conversation about morals, and a student suggested that Atticus puts his morals in front of his kids, which makes

him "not a good father" but a good person. Throughout this discussion, the teacher was able to step back while students talked directly to each other and used the text and examples from their own lives to explore one of the big ideas of the novel: the role of morals in family and society.

Another example of an episode rated as "highly engaged" in the class of a top teacher involved having students work in small groups to read and analyze a short passage called "Fired." An example of an uncritical inference test, the activity led students to challenge their assumptions. Working independently in their small groups, students discussed the questions raised in the activity and prepared a response for the rest of the class. As the teacher brought the groups back together to go over the answers, students began leading the discussion with the whole class themselves without prompting. The teacher then involved the students in identifying the purpose for the activity in light of an upcoming task they were going to perform.

Two observations were noted of top teachers exhibiting a high level of engagement. The level of student work was at the middle level of thinking skills (application and analysis) for all top teacher classes. Only two bottom teacher classes were observed using middle level tasks. More than half of the top classes had students participating in powerful listening and speaking tasks compared to one speaking task in a bottom class. All bottom classes used in-class reading, but only one top class was observed reading. These observations were supported by the teacher surveys where 57% of top teachers reported using 30% or more of their class time in whole group discussion compared to 14% of bottom teachers, and 57% of bottom teachers reported using more than 20% of class time in reading compared to 29% of top teachers.   Analysis of English I EOC student surveys found significantly more students from top classes indicating that they had participated in activity-based instructional techniques than the students of bottom teachers.

Middle School Algebra I

The survey of middle school Algebra I teachers asked teachers to divide their instruction into the following eight instructional delivery methods by giving the percentage of the total instructional time spent on each activity:

- lecture,
- whole group discussion,
- projects,
- small groups,
- technology,
- testing,
- labs, or
- other.

There were three delivery methods where differences were noted between top and bottom middle school teachers: lecture, whole group discussion, and small groups.

Top middle school teachers reported using less lecture than bottom middle school teachers (0% - 30% of class time compared to 25% - 50% of class time, respectively). The median amount of

instructional time in lecture for top teachers was 22.5%, but 30% for bottom teachers. Thirty-eight percent of top middle school teachers reported using lecture 30% of the time while 75% of the bottom middle school teachers reported using lecture 30% to 50% of the time.

The use of whole-group discussion and small groups was also reported at a higher rate by top teachers than bottom teachers in middle school. Whole-group discussion had the same range of 10% to 35% for both groups, but the median was 25% for top teachers and 17.5% for bottom teachers. Seventy-five percent of top middle school teachers reported using whole group discussion at least 20% of the time compared to 50% of the bottom middle school teachers. The range for top teachers' use of small groups was 10% to 75% with a median of 20%, while the range for bottom teachers was 10% to 25% with a median of 15%. Sixty-three percent of top middle school teachers reported using small groups at least 20% of the time compared to 38% of the bottom middle school teachers.

The most effective middle school Algebra I teachers used less lecture and more whole group discussion and small groups than did bottom teacher classes. Overall there was more student ownership of their learning. Top teachers used structured classroom management that provided students with clear definitions of their roles. Top teachers were observed adjusting their instruction appropriately by using frequent formative assessment.

In top teachers' classes, there were organized classroom routines. Students clearly understood their roles. All class time was used on worthwhile mathematical tasks that kept all students engaged. An invigorated pace was used with tightly organized lessons/activities that were broken into manageable sections. There were clearly stated daily objectives.

Summary of Thoughtful Management of Time and Materials

The most effective teachers in all five studies planned their use of time and materials carefully. It varied by subject area and level as to what was considered the most appropriate use of time, but curricular alignment was of utmost importance with structured teacher-led time on task for all students.

Berlin's (1993) essay, *The Hedgehog and the Fox,* as explained by Collins (2001) can also be used to describe the top teachers as focused "hedgehogs" with a single mindedness of purpose contrasted with the bottom teachers as foxes, whom Collins (2001) writes, "pursue many ends at the same time" (page 91). Hedgehogs are more likely to produce quality results because of their focus on the single goal.

LEARNING-CENTERED CLASSROOMS

NBPTS (NBPTS, 1989) Core Proposition 1 is "Teachers are committed to students and their learning."

> Accomplished teachers are dedicated to making knowledge accessible to all students. They act on the belief that all students can learn. They treat students equitably, recognizing the individual differences that distinguish one student from another and taking account of these differences in their practice. They adjust their practice based on observation and knowledge of their students' interests, abilities, skills, knowledge, family circumstances, and peer relationships (p. 3).

Top teachers in these studies planned their classrooms around student-learning needs.

Biology

As stated before, top biology teachers focused the majority of their time on students needs. They were accessible to students to provide extra help on a regular basis. They conducted frequent assessments and held EOC review sessions by selected content.

Algebra I

Many of the classroom behaviors observed in top Algebra I teachers demonstrated their confidence that they could structure classrooms around student needs and make Algebra I accessible to all their students. Top Algebra I teachers had created classroom cultures in which students were free to ask questions, contribute, or offer explanations within a structured classroom. Mutual respect was exhibited between teacher and student. Some bottom teachers had a structured management style with mutual respect evident, but none of the bottom teachers had an open culture in which students freely contributed. All top teachers used sustained feedback (detailed and complete information that students can understand and use to modify their thinking), but none of the bottom teachers gave this type of feedback. Top teachers took time to tell students what types of questions to expect on tests and assignments, while none of the bottom teachers were observed doing so. Top teachers cautioned students about possible errors commonly made; only one bottom teacher was observed doing so. Top teachers used a variety of activities with frequent transitions (averaging 7 in 90 minutes) and exhibited a sense of humor that added a feeling of fun to the classroom. Few bottom teachers used variety and humor. Top teachers took time to emphasize the importance of the effort that was needed to complete assignments and to study.

Most top teachers were observed questioning different students at each step of a problem and using a class warm-up exercise (a task given at the beginning of class) that spiraled to include prerequisite skills necessary for success in the current day's new material. Most top teachers were also observed giving purpose to homework (connecting it carefully to the current lesson and using the homework in the lesson explanations). None of the five bottom teachers were observed using these behaviors.

U.S. History

The top U.S. History teachers were observed making history connections for students. They made connections to current events, to their lives and their students' lives, and to themes across time into the present. They also facilitated the use of students' imaginations to connect into historical settings.

Several examples of connections were given in interviews and classroom observations. One top teacher had students report on newspaper articles. Another top teacher connected Seward's Folly to "Ms [teacher's name]'s Folly in class yesterday." A teacher was observed posing the question "What would happen if you _____?" while another teacher explained "safety valve" in relation to a shared high school prom experience. An example of connecting a theme across time was observed when a teacher connected John Brown to Poncho Villa to Osama bin Laden (all individual fugitives that were or are hard to catch).

Top U.S. History teachers created an atmosphere of mutual respect in which inquiry, wrong answers, personal challenge, collaboration, and disequilibrium provided opportunities for learning for all students. Top teachers were enthusiastic and presented a genuine feeling of joy about being in the classroom with their students. Top teachers were heard making student affirming comments:

- You are the greatest kids.
- I am so proud of what my students can do.
- My job is to connect the dots, because you have so much knowledge already.
- I know that you know this.
- You are so smart.
- The "jeopardy" history questions are too easy for you.

Students also made affirming comments in top teacher classes. One student was heard saying, "We did so good on this!"

In contrast, some bottom U. S. History teachers were observed making teacher-centered comments. Some of the teachers exhibited more concern about how they looked and felt than how students felt. Student behaviors were taken as personal affronts and direct challenges to the teacher's authority. Several bottom teachers were observed frequently challenging student motives and generally being disrespectful of students' feelings. Anger and frustration were observed throughout all of one 90-minute class period. Examples of teacher-centered comments were recorded:

- Listen, this is like pulling teeth.
- I don't know how else to teach it.
- I gave you a handout.
- [Student's name], what did you do last night?
- Put that dang candy up.
- I need to retire.
- I'm so tired of this job that I can't take it much longer.

Teachers at the school with the lowest 2005-06 U.S. History effectiveness index exhibited a defeatist attitude. They talked of what they had to do to prepare for the EOC exam as if they had no control of their classrooms. In contrast, teachers at the school with the highest 2005-06 effectiveness index were upbeat and very positive. They expressed joy, excitement, and pride in their students.

English I

During the 2004-05 school year, all high school teachers and administrators in WCPSS took part in school-level book studies of Marzano, Pickering & Pollock's, *Classroom Instruction that Works* (2001). The book study groups met at various times throughout the year and focused on the effective instructional strategies offered in the text. Marzano et al. used meta-analysis to identify instructional strategies and calculate for each an effect size (a measure of the difference in academic performance of groups that used the particular strategy compared to those that did not).

Nine strategies were found to be most effective:

1. Identifying similarities and differences.
2. Summarizing and note taking.
3. Reinforcing effort and providing recognition.
4. Homework and practice.
5. Nonlinguistic representation.
6. Cooperative learning.
7. Setting objectives and providing feedback.
8. Generating and testing hypotheses.
9. Questions, cues, and advanced organizers (Marzano et al., 2001, p. 7).

Because the teachers were familiar with instructional strategies deemed effective by Marzano et al., the Algebra I and the English I studies analyzed implementation of these instructional strategies. The goal of Marzano's book is to help teachers understand what *they* can do to make a difference for students even when they must deal with issues beyond their control or teach in a school that is not effective overall.

Top English I teachers used more Marzano research-based strategies than bottom teachers. The most effective teacher was observed using six of the seven strategies in one observation. The most commonly used strategies among top teachers were reinforcing effort and providing recognition, nonlinguistic representation, and cooperative learning. By contrast, nonlinguistic representation and cooperative learning was observed in only one bottom teacher observation and reinforcing effort and providing recognition in only two bottom teacher observations.

Top teachers described feeling successful when students shared their achievement in future courses. They focused on effective communication skills while bottom teachers said that passing the EOC was their goal. Even so, top teachers incorporated EOC test practice throughout their courses and realized that Black/African American, Hispanic/Latino, and SWD students were at greater risk of performing below expectations. Bottom teachers expressed acceptance of low

performance of these subgroups and practiced enabling behaviors such as reading to them. They seemed at a loss as to how to prepare for the EOC. The attitudes toward EOC preparation may be related to comfort level with the Standard Course of Study. Top teachers expressed more comfort than bottom teachers.

The most effective English I school had developed a seminar that focused on study skills that supported the mission of English I to prepare students to read and write well across the curriculum. This graded course also supported the goals of English I since this course is about reading comprehension. The teachers used the same vocabulary program in all English I classes.

Middle School Algebra I

Top teachers in middle school Algebra I had a classroom culture in which students were free to ask questions, contribute, or offer explanations. Observers recorded examples of inquiry, wrong answers, personal challenge, collaboration, and disequilibrium. In one class, there were two volunteers for the same problem, and each was asked to put the solution on the board *for comparison*. Students seemed quite comfortable doing this. They were willing to take the risk of being wrong, but also knew that there might be two ways to get the right answer. In accepting a student's answer, a teacher said, "That's right. Usually I add the 4 and 8 and then subtract the 7 but you can add in any order that you like." In another class, the teacher said, "Your group is the only one that made a chart. Will you go up and explain it?" The student responded, "Sure. For our formula, we looked at the second difference…"

Activities in top teacher classes centered on mathematical understanding, invention, and sense-making. Three supporting teacher quotes were heard:

- "Why do we assume that the variables all represent nonnegative numbers under the radicals?" (note: all the radicals were square roots).
- "Very good! I'm so glad that I asked you since I never thought of it that way."
- "What are the restrictions on these rational expressions? Be sure to list them first."

Within this structure, teachers were able to capitalize on unexpected learning opportunities and adjust instruction appropriately to meet student needs. Teachers listened carefully and used formative assessments regularly. In one of the observations of a top teacher, the lesson for the day was put aside while more work was done on the homework task because many students had questions. On the other hand, one of the bottom teachers was observed repeating an entire lesson as the student who asked a question was saying, "I only wanted one example," and the other students were restless and inattentive.

One top teacher taught students to be mathematicians using a repetitive instructional exploration rubric with each new topic. This teacher also explained upcoming test grading rubrics as quizzes were marked by students in class, thus enabling students to take ownership of their learning.

Observations of bottom teachers provided, on the other hand, some examples of a less positive classroom culture. In one class the teacher's response to a student asking, "Why is it the vertical line test and not the horizontal?" was "Because it's the vertical line test." Student "why" questions were answered with statement such as, "This is the way it's done, remember your

properties, and the steps." In another class, an open-ended question was accepted with only one answer, and a student who wanted to offer another solution was turned away.

Top middle school Algebra I teachers were persistent in giving, revisiting, and adjusting feedback to students. One teacher said, "I went back and did some problems at home last night and the slide method does not always work, let me show you." Other quotations were recorded:

- "You've got some mistakes in there, try again."
- "I should see better things on the scientific notation than I saw on the homework."
- "I think what you meant to do was pull out the GCF. Will you come up and fix that?"
- "[student's name] had a good idea of building a smaller model and working with smaller numbers."

Top middle school Algebra I teachers asked probing questions of students. Examples of some probing questions recorded during observations included the following:

- "What is another way we could solve this?"
- "How do we know she has the right solution?"
- "How many of you have a different approach? We would like to see it."
- "How many ways are there to approach these problems?"
- "Which one of these explanations helped most?"

Top teachers described their students as motivated, conscientious, going above and beyond, thirsting for learning, perfectionists, delightful, and fun to teach. Top teachers concluded that middle school Algebra I is a challenging course that works well for students who should be there. Bottom teachers described their students as the sharpest, the brightest, good students, hard workers, but not all motivated. They said that some students are not willing to "dig" and do work on new topics. They also said that some students are placed in Algebra I by a parent regardless of whether the teachers think the child is ready and "drag down" the class.

Summary of Learning-Centered Classrooms

The term learning-centered classrooms is used to identify classrooms in which teachers spend all their planning time and in-class time focused on what is best for the academic development of all their students. These teachers spend no time using the pronoun "I." They focus on the "we" in their classrooms.

During the focus-group interviews, top teachers spent time sharing instructional strategies, while bottom teachers spent most of the time complaining about their lack of time. Bottom teachers also placed more blame on their students' lack of prerequisite skills and motivation. Top teachers discussed ways to teach the study skills that students needed to succeed. They also shared ways to motivate all students to want to learn with in-class and out-of-class enrichment activities.

PROACTIVE PLANNING

The most effective WCPSS teachers in these studies planned with other teachers and had a written plan prepared before the school year began. It should be noted that the Biology, Algebra I, and U.S. History studies were conducted before the WCPSS districtwide implementation of professional learning communities (PLCs).

Biology

Seven of the 10 top biology teachers said that they planned for instruction with one or more teachers, but six of 10 bottom teachers reported always planning alone. The district provided a pacing guide for biology instruction with suggested classroom tasks. Of the top teachers, only one teacher (who had participated in writing the pacing guide) reported using most of the suggested tasks. Nine top teachers used some or none. Of the bottom teachers, five marked most or many, four some, and only one none. Top teachers reported planning most of their activities themselves, while more bottom teachers used resources already prepared.

All 10 top teachers reported that they used data in the planning of instruction, while three bottom teachers stated they had no time for data (including one department chair of a school with a low effectiveness index). Nine of the 10 top teachers reported using data that they collected, and nine used data from the school and district administration. Two top teachers were at a school that had developed common classroom assessments that were used to report proficiency on biology goals to students and to provide goal-based regular structured remediation to students.

The school with the highest district effectiveness index (two of the top teachers taught in this school) used goal summary reports provided by the state testing program from previous years to plan the pacing and delivery of instruction. A "year at a glance" document was written. The instruction was goal-driven, not book-driven. This was also the school where a first-year teacher had a top-ranked residual average in 2005.

Algebra I

Most top teachers (eight of nine) reported planning with other teachers, while six of nine bottom teachers planned alone. In response to how common planning time was used, all the top teachers chose pacing as either first or second in importance. Six of nine top teachers set their own pace, while five of nine bottom teachers used a district-prepared pacing guide.

The two schools with the highest effectiveness indices in Algebra I prepared complete course materials during the summer prior to the first year of implementation of a new revised version of the Algebra I NCSCS. Both schools wrote their own pacing guides using the district pacing guide as a model. At one top school, the school wide plan was for all Algebra I teachers to use the same daily homework assignments. At the other top school, a commercial curriculum with a book and supplemental materials was used, but the pacing guide was a school-prepared one and many additional lessons were written in order to fully address the NCSCS, especially the technology requirements. Both schools had spiraled curriculum that remediates weak

prerequisite skills within the new material. Both schools emphasized problem solving and processes.

Both top schools had support structures for teachers, with special consideration of new teachers; they handed teachers the prepared materials for the entire course. They also had experienced teachers meet with new teachers to listen to their concerns, explain the materials, and help with test writing. All the teachers of these top schools expressed a pride in their department and felt part of a successful team.

One of the bottom schools had no team planning, while the other school's teachers spent much of their planning time expressing negative opinions toward any suggestions for ways to improve (there were many "yes, but" comments made). Teachers at this school said that they planned together, but there was no concrete evidence of a school wide plan. When asked by their principal to show weekly lesson plans, they seemed overwhelmed at how to fulfill this request.

U.S. History

Top teachers used their background knowledge to prepare student guides, graphic organizers, warm-up questions, and many other supplementary teaching aids. They did not rely solely on textbooks, handouts, and worksheets that were available from commercial vendors. One top teacher said, "The textbook is not the curriculum. No boring worksheets used in my class." This teacher had a very negative opinion of worksheets that were being used in the classrooms of some colleagues. Another top teacher was observed telling students, "I want you to get tomorrow's N&O (the local daily newspaper) insert on the 1898 Wilmington Race Riot for us to use."

Top U.S. History teachers reported that they planned with other history teachers, efficiently focusing the planning time around concepts and strategies. This desire to learn from peers was observed during the focus-group interviews. The top teachers were anxious to hear the strategies of their colleagues in the district. They discussed how they taught reading and note taking, included current events, and supported the classroom experience with out-of-class activities. The bottom teachers spent much of their focus-group time discussing the lack of time on the block schedule, unreasonable expectations of the curriculum, and their frustration that students cannot read and write. Although top teachers shared many of the same concerns that bottom teachers had, they did not use their planning or meeting time to vent about these issues.

Middle School Algebra I

Five of eight top teachers and seven of eight bottom teachers reported that they had shared planning time with colleagues. Top and bottom middle school teachers agreed that the main use of the shared planning time was for lesson planning. Five of eight top teachers marked lesson planning as the top use of time and two more top teachers chose lesson planning second. Seven of eight bottom teachers chose lesson planning first.

The high school teachers had marked pacing as their top use of shared planning time. Since all but one middle school teacher reported using most to all of the WCPSS Instructional Calendar, it was concluded that middle school teachers used the pace set by the calendar.

There was less concern about how to remediate prerequisites with the well-prepared Middle School Algebra I students. When asked to rank the importance of Algebra I topics defined by the names of chapters in an Algebra I book, top middle school teachers ranked the "basics of algebra" last of 14 topics and bottom teachers ranked the basics 10th. Besides the "basics," top middle school teachers found the task of ranking the topics to be a difficult one. Two top teachers stated that all topics were of equal importance. Using the average rankings, 7 of 14 topics were ranked in the top five in importance. Since several of the topics from the algebra book are not in the state curriculum, it can be concluded that Middle School Algebra I teachers spend time on topics not in the state curriculum. Middle school teachers used planning time to create lesson plans that progressed in a linear fashion throughout the curriculum. The main difference between top and bottom middle school teachers was the importance placed on the basics. Top middle school teachers ranked this topic last, while bottom middle school teachers ranked four other topics below the basics.

English I

English I teachers at the school with the high effectiveness index were noted as being more strategic in their approach to instructing their students. Similar patterns were noted in the focus group interviews of teachers in the top group and the bottom group.

It is interesting to note that the top three teachers all reported that they were very comfortable with the NCSCS; whereas two of the three bottom teachers reported that they were only somewhat comfortable with the NCSCS and one bottom teacher was only "ok" with some parts of the NCSCS.

When considering what teachers use to guide their instruction, an interesting distinction was observed between top and bottom teachers. While top teachers expressed a need to expose students to aspects of the English I EOC, teachers in the bottom group were less likely to be strategic in thinking about how to include preparation for the EOC into their instruction. In fact, one bottom teacher said that he wants to avoid knowing much about the EOC because he is afraid he will teach to it. A teacher from the bottom school said that she has a "love/hate" relationship with the EOC. Teachers in the top group, on the other hand, were heard telling students how what they were teaching related to the EOC and offering connections during instruction.

Summary of Proactive Planning

Effective teachers in these studies had a plan before the school year began. If the plan was a school wide one, then the entire school was more likely to be effective and new teachers were supported to success quickly. The plan was aligned to the NCSCS, with textbooks as one among many possible resources. Teachers planned the objective for the day by a concept or goal

description and not by a chapter number or name from a textbook. The course plan was regularly updated to reflect the needs of students and curriculum.

CONCLUSIONS

The main goals of these research studies were to collect system-specific data to help teachers, principals, and district leadership understand current teaching practices, identify and share best instructional practices, build a series of studies that identify the role of teachers and other system staff/departments in the school improvement process, and to identify the practices of effective improvement.

In 2008-09, the proficiency of all WCPSS high school students tested was 79.6%. The performance of subgroups ranged from 55.7% to 90.8%. Only 10 of 23 WCPSS high schools made "high growth." The percentage of students with positive "academic change" was 55.5% overall and ranged from 49.3% to 65.9% by subgroup, performing short of the WCPSS Board of Education goal that all students will demonstrate high academic growth. The five studies summarized in this paper identified teaching practices of the most effective WCPSS teachers, giving local examples of best practice that can be used to make progress toward the Board goal.

The WCPSS effectiveness indices for schools and the average residual scores for teachers were used to identify highly effective teachers and schools in order to document these best instructional practices. Teacher surveys, classroom observations, focus-group interviews, and student surveys were used.

Four key areas of best practice were found. There are subject area differences in the implementation of each finding, yet all four areas are present among most effective teachers in each study. The four areas are:

- high academic expectations for all students,
- thoughtful management of time and materials,
- learning-centered classrooms, and
- proactive planning.

It was found that the attitudes teachers reported on surveys or in focus-group interviews were closely related to setting high expectations for all students. Both top and bottom teachers often expressed concern over the lack of prerequisite background knowledge and study skills that students brought into their current course. Yet top teachers expressed more faith in both their students' abilities to learn the missing skills and in their ability to teach students these skills. More class time was spent in higher level thinking skill activities that focused on the curriculum goals of the current course. Concepts were stressed over memorization. All students were expected to actively participate in all assignments.

Top teachers of all five studies were thoughtful in their management of time and materials. They could justify why they had chosen a particular activity or why they were or were not using the book. They realized the importance of time on task and allowed no unplanned time for students. The use of time and materials was closely related to creating learning-centered classrooms

(classrooms where student needs were always of upmost importance). Top teachers took responsibility for the success or failure of their students, while bottom teachers spent time complaining about student background, student preparation, the lack of adequate time, and even the curriculum itself. Top teachers said that the curriculum was what it was and they knew that they could teach it so they had no time to waste on complaining. They spent their energy on learning about and sharing best practices for each student in their subject discipline.

All top teachers practiced proactive planning. They devoted time before classes began to study the district instructional guides and develop their own "year-at-a-glance" documents. These teacher guides were usually planned in school teams and used school wide. Formative assessments along with district-provided data were used throughout the school year to modify and adjust these plans. There was always room in the plans to flex to meet student needs on a daily basis. This proactive planning was the vehicle that facilitated the setting of high expectations within learning-centered classrooms. Students experienced a structured classroom atmosphere within which they were valued and expected to succeed. One teacher said, "Our students are proud of what they can do."

It can be concluded that teachers with higher average WCPSS residuals do have a more complete package of instructional strategies than do their peers with lower residual averages. The five studies within this body of work (Biology, Algebra I, U.S. History, Middle School Algebra I, and English I) have all found clear evidence of excellence in teaching among top teachers. Better performance by students on EOC exams is strongly correlated with better teaching. These top teachers do not focus on the EOC exam; they focus on the Standard Course of Study and helping students master it at the highest level possible, not just at the minimum level needed for the exam.

DISCUSSION AND IMPLICATIONS

Top teachers in all five studies distinguished themselves from bottom teachers through their beliefs and behaviors. Top teachers developed systems and structures to support the success of all students. Observations clarified that the attitude that a teacher holds is the attitude that the students adopt. It is also clear that WCPSS students can achieve more than some teachers expect of them. The interviews and observations showed that most of the bottom teachers liked students and thought they were doing their best to help them succeed. They all reported on the survey that they viewed themselves as successful. It is hoped that sharing the success and attitude of top teachers will help all teachers catch a vision of what is possible.

School-based Professional Learning Communities (PLCs) are encouraged to have teachers reflect and share their current classroom practice in the light of the findings of these studies. Until 100% of WCPSS students score proficient and meet their individual growth targets, there is much work to be done by all.

The following recommendations for improvement are made to all WCPSS EOC course teachers:

- Study the standard course of study and EOC testing program.
- Plan with other teachers.
- Understand and implement Marzano/research-based instructional strategies.
- Use and/or develop a strategic course plan that addresses incoming students' deficits.
- Design tasks that use higher order thinking skills.
- Involve students actively in class.
- Hold high, rigorous expectations for all students.

The following recommendations are made to school-based leadership:

- Develop a school plan that aligns to the standard course of study, emphasizing rigor and relevance.
- Support and expect meaningful common planning for teachers.
- Share results data with teachers including effectiveness rosters and indices.
- Develop a scheduling plan that maintains stability in each of the core subjects.
- Support a school culture that promotes high, rigorous expectations for **all** students.

The following recommendations are made to district leadership:

- Make observations of effective schools and teachers that can be shared districtwide.
- Provide workshops on implementing Marzano/research-based instructional strategies.
- Support schoolwide improvement efforts based on top school models.
- Support teacher improvement efforts.
- Provide data to teachers and schools on their effectiveness.

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APPENDIX A

METHODOLOGY

IDENTIFYING THE MOST EFFECTIVE TEACHERS

The most effective WCPSS teachers were identified by using a multiple regression analysis of the state EOC test scores. This analysis generated for each student, teacher, and school a measure of whether their test scores showed a level of performance that was either higher, lower, or about what was expected, compared to other WCPSS students, teachers, or schools. The first study of biology teaching and learning demonstrated that teachers and schools that consistently produce more achievement in students regardless of a student's initial skill level can be identified (Haynie, 2006).

RESIDUALS AND THE EFFECTIVENESS INDEX

Since the early 1990s, WCPSS has used a multiple regression analysis of each state test to generate an "effectiveness index" for each school, which ranks the schools within WCPSS. This regression analysis uses the current year's test scores as the outcome and previous state test scores as the predictors. The analysis also takes into account each student's special program status (level of service for special education, e.g. self-contained), free or reduced-price lunch (FRL) status, and AG status as well as the percentage of FRL students in the school. A residual score is calculated for each WCPSS student who took the test and had previous test score predictors. The residual score for a student is the difference between the student's actual score and the score that the regression analysis model would have expected, given the student's previous test scores and program characteristics. These residuals give a measure of how students performed compared to other similar students in WCPSS, that is, students with similar previous test scores and program identifiers.

As an example, Figure A1 gives a hypothetical visual of the regression analysis for English I with three of the many possible prediction lines. It shows that the predictions are both dependent on previous EOG and/or EOC scores and also the students' program characteristics, such as AG, or disability status and FRL status. The middle black line could represent students with no identifiers.

Figure A1
**English I Regression Scatter Plot**
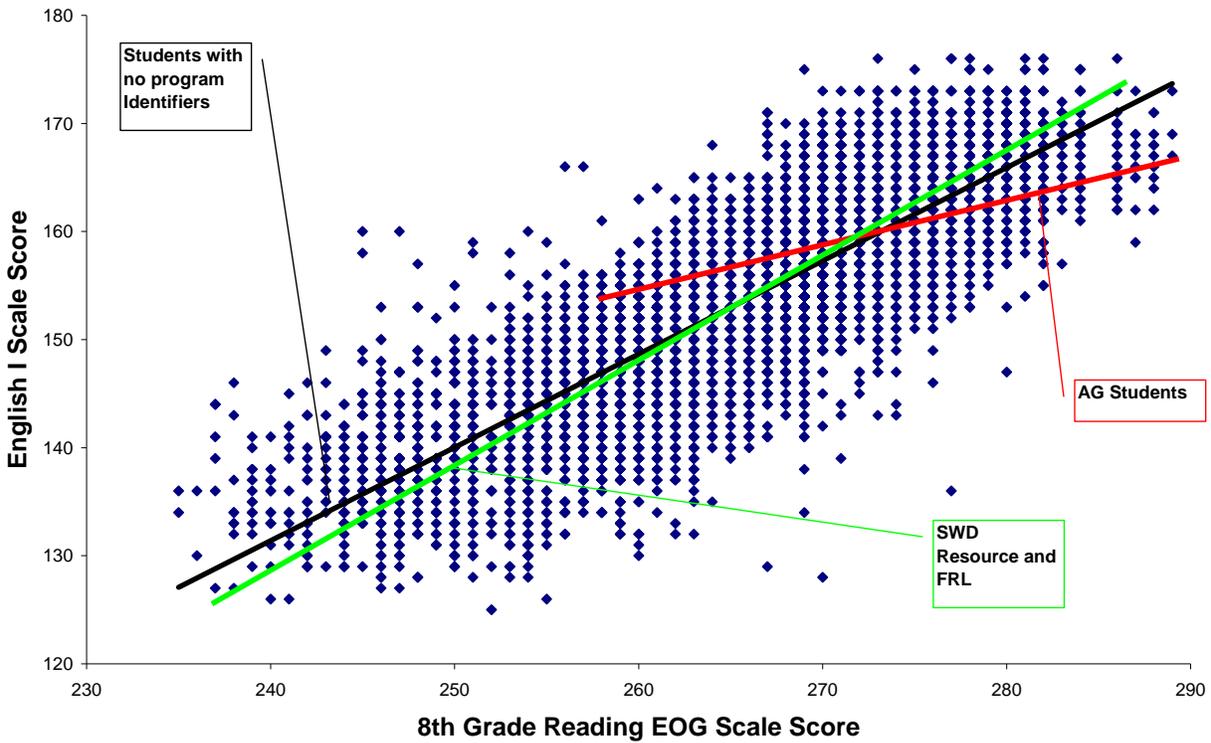
Figure A2 shows one vertical slice of the regression model for students whose prediction line is the AG line of Figure 3 and whose 8th-grade EOG score was 275. The line at the center is the predicted score generated by the model for these students. A residual is the difference between the actual score and the predicted score. Scores above the line have positive residuals and scores below the line have negative residuals.

Figure A2
Student Residuals for Academically Gifted Students

English I scale score 175, residual 175-162 = 13

These scores have positive residuals.

This is the predicted score from the regression model.

English I scale score 162

These scores have negative residuals.

8th-grade EOG score of 275
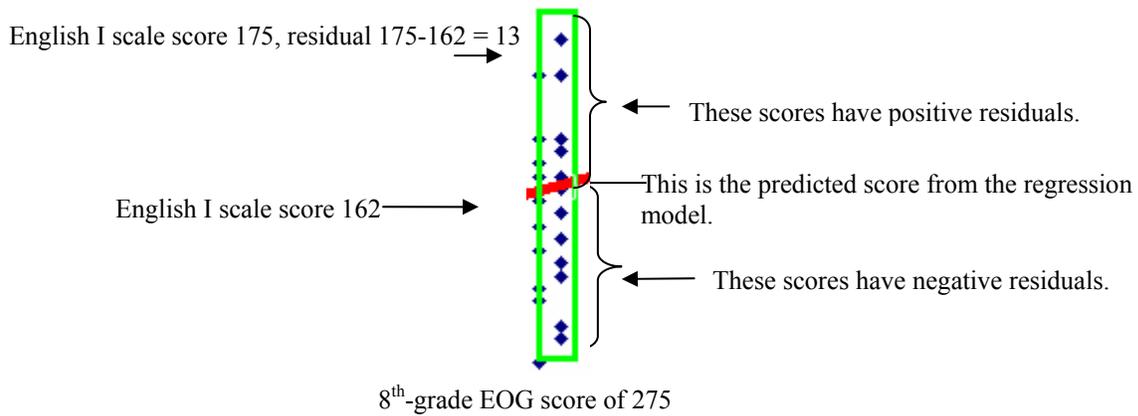
For each test given, the residuals are averaged across all students in the school, and a standardized z-score (effectiveness index) is generated for each school by subject. A z-score is the number of standard deviations that the school's residual average is from the average (mean) of all the schools. If the z-score is greater than 1, then the school knows that its students in that course have scored significantly higher (among the top 16%) than the other students in the district who have similar previous test scores and program characteristics. Similarly, if the effectiveness index is less than -1, then the students have scores much lower (among the bottom 16%) than the students in other schools. Values between −1 and +1 are within one standard deviation of the WCPSS average and are considered "typical" or expected.

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Table A1 is an example of a WCPSS high school effectiveness z-score report. This school was among the top schools in the district for effectiveness in Algebra I, Algebra II, Geometry, Biology, and Physical Science; yet the effectiveness scores were among the bottom in Civics/Economics and U.S. History. The effectiveness scores in English I, Chemistry, and Physics were about the same as the average scores in the district.

Table A1
Effectiveness Indices for a WCPSS High School

End of Course	z Score
Algebra 1	1.02
Biology	1.82
Civics	-1.00
English 1	0.32
US History	-1.44
Algebra 2	1.26
Chemistry	-0.25
Geometry	1.61
Physical Science	1.37
Physics	-0.40

WCPSS principals receive rosters of student residuals by teacher, course, and section. In these rosters, student residuals above one standard deviation are coded in green, and student residuals below one standard deviation are coded in red. The standard deviation in scale-score points of these residual scores is displayed at the bottom of the roster, along with the average residual for the section.

Table A2 is a sample roster for a 2008-09 English I class of 19 students. For each student, the predictor scores are shown. The predictors for the English I EOC are the 8th-grade reading and mathematics scores. The roster then displays the English I EOC scale score and the residual score for each student. These residuals are averaged and an average residual score for the class is provided. The average residual for this class was 0.09. The principal and teacher can then determine how successful students were on the EOC as compared with other students with similar characteristics. Notice that Student 6, Student 12, and Student 16 have the same scale score on the English I EOC exam, but Student 6 has a negative residual while Student 12 and Student 16 have positive residuals with Student 16's residual higher than Student 12's. Student 16 has a lower scale score than Student 4 but a much higher residual. The residual shows a measure of performance as related to previous performance and other educational indicators, and gives a sense of the relative growth for each student. Students 1 and 2 have no residuals, as these students are missing previous test scores.

Table A2
Sample High School English I EOC Residual Roster

Name	8th-Grade EOG Reading Scale Score	8th-Grade EOG Math Scale Score	2009 EOC English 1 Scale Score	2009 English I Residual
Student 1	.	.	156	.
Student 2	.	.	151	.
Student 3	256	345	135	**-5.87**
Student 4	281	363	154	**-5.60**
Student 5	259	356	142	**-5.08**
Student 6	261	360	146	-3.11
Student 7	262	354	144	-2.54
Student 8	254	350	141	-1.98
Student 9	242	347	133	-1.22
Student 10	245	343	134	-0.30
Student 11	254	348	144	0.17
Student 12	258	347	146	0.28
Student 13	259	352	145	0.54
Student 14	265	345	150	2.37
Student 15	266	363	155	3.39
Student 16	258	346	146	3.51
Student 17	262	353	152	4.04
Student 18	259	357	155	**6.35**
Student 19	271	372	163	**6.56**

Note: Class Average = 0.09   Standard deviation = 4.61
Interpretation Example: Student 18 had an 8th-grade reading scale score of 259 and an 8th-grade math scale score of 357. Student 18's 2009 English I scale score was 155 and the student's residual was 6.35. This student scored among the top 16% of students with the same English I score, the same 8th-grade reading and math scores, and the same program indicators.

TEACHER RESIDUAL AVERAGES

The student residual scores and the effectiveness indices give the district a comparison basis for schools and students. Prior to 2005-06, residuals had not been averaged or standardized at the teacher level beyond the classroom roster. Teachers were encouraged to study their rosters for trends in student performance, and some principals had compared teachers within their school, but no districtwide comparisons had been made. The study of biology teaching by Evaluation and Research Department staff in 2004-05 was a first attempt at identifying the success of teachers, as indicated by average residuals, and then to identify the specific aspects of the practice of highly effective and relatively less effective teachers in order to isolate teachers' classroom practices that may be associated with high student achievement.

In each study, teacher identification began with current teachers who had taught the subject for the three consecutive years prior to the study year. It was assumed that more data would produce more accurate and stable results. The number of teachers that met this criterion was about 30% of the total teacher pool in each subject:

- Biology: 43 teachers,
- Algebra I: 41 teachers,
- U.S. History: 29 teachers,
- Middle School Algebra I: 36 teachers, and
- English I: 42 teachers.

For each identified teacher, an average student residual was calculated across all years and classes. Teachers were ranked on effectiveness from highest average to lowest. In each study 7 to 10 teachers were labeled as top teachers and an equal number as bottom teachers. These teachers became the focus of analysis.

DATA COLLECTION AND ANALYSIS

In each study a mixed method approach was used. Comparisons of top and bottom teachers were made using multiple data sources:

- teacher surveys,
- observations,
- student scores, and
- focus-group interviews.

The teacher surveys contained common questions across subjects for synthesis, but also each survey contained some subject-specific questions. Classroom observations were made by both the Evaluation and Research administrator and the Curriculum and Instruction administrator. The Evaluation and Research administrator was the same for all studies. In the Biology study, interviews were conducted at each school of all biology teachers. All other studies conducted focus-group interviews of the most effective and least effective teachers. Focus-group interviews of the most effective and least effective schools were conducted in the Algebra I, U.S. History, and English I studies. There were too few Algebra I teachers at the middle school level to conduct school interviews.