



SREB

State Leadership in Improving High Schools for More Students

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State Leadership in Improving High Schools for More Students

Over the last 13 years *High Schools That Work (HSTW)* has evolved into a promising vision for improving the achievement of high school students. *High Schools That Work* is a partnership of state and local education leaders and a regional organization, the Southern Regional Education Board.

The *High Schools That Work* dream is that public high schools will help many more students meet high standards by building educational programs around college-preparatory-level academic studies and challenging career concentrations. *HSTW* dreams that schools will emphasize high standards and student learning above all else. *HSTW* believes that almost all students can learn advanced-level academic and technical concepts when they are nurtured in an environment of high expectations and support.

Based on results of the 1998 *High Schools That Work* Assessment of more than 34,000 students at 770 *HSTW* sites in 22 states, this report answers three questions:

- What progress is being made in getting more career-bound students¹ to meet the *HSTW* performance goals?
- Which school and classroom experiences are associated with higher achievement?
- How can states move toward getting 85 percent of career-bound students to meet the *HSTW* performance goals? (For examples of the types of skills possessed by students who meet the *HSTW* performance goals in reading, mathematics and science, see the sidebar titled “Meeting *HSTW* Performance Goals: What Students Know and Can Do” on Page 2.)

Progress in Meeting the Goals

For the first time, about half of career-bound students at *HSTW* sites met the *HSTW* goals in reading, mathematics and science in 1998. Forty-nine percent of students met the reading goal, up from 33 percent in 1993/1994²; 56 percent met the mathematics goal, up from 34 percent in 1994; and

51 percent met the science goal, up from 39 percent in 1993/1994. At the 25 percent of *HSTW* sites classified as high-achieving, where minorities account for 22 percent of enrollment, about two-thirds of the students met each goal. (See Table 1.)

¹ Career-bound students are the 60 percent to 65 percent of high school students who plan to work, attend a two-year technical or community college, enroll in a four-year college or university with an open admissions policy, or enter the military after high school graduation.

² The 1993/1994 information is based on assessment data from all *HSTW* sites that tested in 1993 and from sites that joined *HSTW* in 1994 and took the 1993 assessment.

Table 1

Percentage of Students Meeting the <i>HSTW</i> Performance Goals	All Sites		High-achieving Sites		Goal
	1993/1994	1996	1998	1998	
	Reading	33%	43%	49%	
Mathematics	34%	44%	56%	69%	85%
Science	39%	38%	51%	66%	85%

High Schools That Work knows that most students can meet the *HSTW* performance goals and knows how to make it happen. *HSTW* and participating states must plan and act purposefully to help these students.

Every category of students participating in the *HSTW* Assessment experienced significant gains in achievement from 1996 to 1998. Even so, schools

have a long way to go to reduce traditional gaps in achievement between groups of students. In 1998, male students made greater gains in reading than female students, while female students made greater gains in science than male students. However, a significantly higher percentage of girls met the reading performance goal, while a significantly higher percentage of boys met the mathematics and science goals. (See Table 2.)

Meeting *HSTW* Performance Goals: What Students Know and Can Do

Reading

- seek and use information from manuals, journals, periodicals and other documents
- use information from several sources to make interpretations and draw conclusions
- identify and solve stated problems
- recognize limitations in available information

Mathematics

- understand concepts from algebra, geometry and probability
- apply concepts from algebra, geometry and probability in solving multistep problems
- explain reasoning in a number of problem-solving situations

Science

- apply knowledge, skills and reasoning to interpret scientific and technical data from tables
- make inferences about outcomes of experimental procedures
- evaluate the appropriateness of an experiment's design
- interpret scientific text and graphs

Two factors contributed to female students' higher performance in reading. First, 41 percent of girls completed four years of college-preparatory English, compared with only 33 percent of boys. Second, most girls were enrolled in vocational programs — business studies and health studies — that require extensive use of language.

Boys' higher scores in mathematics and science cannot be attributed directly to the courses they took. More girls than boys completed the mathematics and science portions of the *HSTW*-recommended curriculum. However, the vocational courses boys took — agriculture, drafting, electronics, automotive technology, construction and manufacturing — contain significant amounts of mathematics and science.

African-American and white students made comparable achievement gains in 1998, but the percent-

ages of these students who met the *HSTW* goals remained very different. About the same percentages of African-American and white students completed college-preparatory English, mathematics and science courses, but their achievement levels were not the same. The difference is related to the quality of instruction and the standards to which students were held. In other words, lower quality means lower standards. (See Table 3.)

African-American students appear to benefit from end-of-course exams linked to a comprehensive accountability system. For example, more than half of the African-American students who participated in the 1998 *HSTW* Assessment in North Carolina, where such exams are used, achieved the *HSTW* goals in reading and mathematics. These students also scored significantly higher in reading, mathematics and science than African-American students in other states.

Table 2

Percentages of Male and Female Students Meeting Performance Goals at All <i>HSTW</i> Sites	Male		Female	
	1996	1998	1996	1998
	Reading	35%	44%	50%
Mathematics	48%	60%	42%	53%
Science	46%	56%	32%	48%

Table 3

Percentages of African-American and White Students Meeting Performance Goals at All <i>HSTW</i> Sites	African-American		White	
	1996	1998	1996	1998
	Reading	29%	35%	48%
Mathematics	26%	36%	50%	63%
Science	16%	30%	46%	60%

Meeting Curriculum and Performance Standards

Setting accountability goals high enough is a key part of improving student achievement. The 1998 *HSTW* Assessment results revealed the significant effect that performance and curriculum standards had on student success.

Requiring students to take a solid academic core and at least four courses in a career field — all of which are taught to high standards — is the most important factor in improving student achievement. *High Schools That Work* provides specific guidelines for a challenging curriculum. (See sidebar.) **Results from the 1998 assessment show that the highest average scores were achieved by the group of students who met at least two of three (reading, mathematics, science) academic curriculum standards, completed a career/technical concentration and met all performance standards.** These criteria are used to determine whether students qualify for the *HSTW* Award for Educational Achievement; 23 percent of students who took the *HSTW* Assessment in 1998 were in this category.

The *HSTW* Assessment is based on the National Assessment of Educational Progress exam and uses the same scoring formula. Career-bound students who met at least two of three academic curriculum standards, completed a career/technical concentra-

tion and met performance standards in every subject scored higher on the *HSTW* Assessment than a sample of college-preparatory students scored on the NAEP exam. (See Table 4.) These career-bound students reached the proficient level, which signifies “mastery over challenging subject matter,” in mathematics and science and came within one point of proficiency in reading. (Proficient-level scores are 304 to 347 in reading, 300 to 349 in mathematics, and 300 to 349 in science.)

Students who did not meet all curriculum standards but met performance standards in all three areas — reading, mathematics and science — were the second-highest-performing group. This group’s average scores significantly exceeded the scores of all students who met all curriculum standards. Thirty-one percent of students tested in 1998 fell into the second-highest-performing group. (See Table 4.) Why was the number of students who met only the performance standards greater than the number who met both the performance standards and at least two of three of the academic curriculum standards? The explanation is that high schools offer many levels of courses, and even the best students often opt to take less-demanding courses. Students who met only the performance goals would have performed

HSTW-Recommended Curriculum

- **English:** four full-year, college-preparatory-level courses
- **Mathematics:** at least three credits, including two credits equal to Algebra I, geometry or higher-level courses
- **Science:** at least three credits, including two credits equal to chemistry; physics; or lab-based, college-preparatory biology
- **Concentration:** four credits above the academic core in an academic, career/technical or blended major

Table 4

Student Preparation and Student Performance	Average Scores		
	Reading (<i>HSTW</i> goal: 279)	Mathematics (<i>HSTW</i> goal: 295)	Science (<i>HSTW</i> goal: 292)
Met two of three academic curriculum standards, completed a career/technical concentration and met all performance standards	303	325	319
Met all performance standards	302	322	317
Met all curriculum standards *	288	311	302
Met some curriculum standards	285	302	297
Met no curriculum standards	271	283	284
Scores on National Assessment of Educational Progress exam for sample of national college-prep students	302	317	307

* This group includes students who met performance standards as well as those who did not.

even better if they also had completed the recommended curriculum.

The group with the third-best performance was the group of students who met all curriculum standards. All students who met all curriculum standards (27 percent of all students tested in 1998) were included in this group, regardless of whether they met the performance goals in one or more areas. Although the average scores for the group still exceeded the *HSTW* performance goals in reading, mathematics and science, the scores were lower because some students in this group did not meet the performance goals. The average scores for this group also were lower in each subject than the comparable NAEP scores of the sample of college-prep

students. The fact that some students who met all of the curriculum standards did not meet the *HSTW* performance goals shows that simply taking the right courses is not enough if these courses are not taught to high standards.

Overall performance declined when students met some curriculum standards but not all of them. These students failed to reach the proficient level in either reading or science but still met the *HSTW* performance goals. **Students who met no curriculum standards had the lowest performance.** These students did not meet any *HSTW* performance goals and did not reach the proficient level in any area. Their average scores were much lower than the average scores of students who met all curricu-

Even the best students in today's high schools are tempted to take less-demanding courses when they are offered a choice of many levels of courses.

lum and performance standards. **To be effective in improving student performance, state accountability systems should include both curriculum and performance standards.**

The good news is that the percentage of students who complete components of the *HSTW*-recommended academic core is increasing rapidly and more students are meeting the performance goals.

In 1998, 77 percent completed the recommended curriculum in mathematics and 54 percent completed the science curriculum.

The area of greatest concern is English. In 1998 only 37 percent of career-bound students completed four years of college-preparatory or honors English. (See Table 5.)

An Agenda for Change

State actions continue to be a critical factor in education reform. State standards, policies and leadership set the tone and direction for local improvements in education. States need to focus on the

things that are most likely to improve school and classroom practices and student achievement. The Southern Regional Education Board has identified four challenges that states need to address:

Challenge 1: Get 85 percent of career-bound students to meet the *High Schools That Work* curriculum and performance goals.

While no state has met this challenge, some are closer than others. *HSTW* believes that 85 percent is reasonable and attainable if states and local schools work together to make changes that will foster school improvement.

State Actions

The following actions will help states meet this challenge:

■ **In revising state goals for accountability, require high schools to increase annually the percentages of students who meet curriculum and performance goals in reading, mathematics and science.**

Students should be required to complete either a college-preparatory program of study or the *HSTW*-recommended curriculum of an academic core and a career concentration. Almost all SREB states recent-

Table 5

Percentages of Students Completing Components of the <i>HSTW</i> -recommended Curriculum	All Sites		High-achieving Sites	Goal	
	1993/1994	1996	1998	1998	
Reading	7%	32%	37%	44%	100%
Mathematics	52%	66%	77%	81%	100%
Science	35%	40%	54%	60%	100%

Setting High Standards for Accountability

North Carolina requires high schools to increase annually the percentage of graduates who receive either college-prep or college-tech-prep diplomas. (College-tech-prep has the same requirements as the *HSTW*-recommended curriculum.) In the last three years, the percentage of students who earn college-prep or college-tech-prep diplomas has increased from 60 percent to 69 percent.

West Virginia holds schools accountable for increasing annually the percentage of students who meet state goals for student performance. West Virginia set a goal that high schools would increase the percentage of students each year who scored in the 50th percentile or higher on the Stanford Achievement Test, 9th Edition (Stanford 9), by the end of grade 11. The percentage of students who meet this goal has increased from 56 percent to 62 percent in the last three years.

ly have raised graduation requirements. However, many states may not require the rigorous studies specified in the *HSTW*-recommended curriculum. Although it is important to match the required number of credits, it is even more important to ensure that the courses are college-preparatory-level. This level of rigor should be required for graduation. (The sidebar above describes the accountability provisions of two SREB states that have the right idea.)

Linking curriculum and performance standards maintains the emphasis on quality content and instruction. It is not enough to require career-bound students to complete tougher courses; teachers also need to use instructional methods that engage these students in higher levels of learning.

Schools that do not make reasonable progress toward meeting these standards would be classified as low-performing or nonimproving, as defined by state classification systems, and would be required to take specific actions to meet the accountability goals. This approach is reasonable and aligns well with states' current accountability activities.

■ Make the *HSTW* Assessment part of the state assessment program.

Very few states require 12th-grade examinations as part of their assessment programs, but many states have made the *HSTW* Assessment given in grade 12 the largest — or only — comprehensive test that seniors take in reading, mathematics and science. Adding a 12th-grade test to states' assessment systems would bring a focus on students' experiences at the end of high school. Most states require high school graduation tests beginning at the end of 10th grade; as a result, students may see the last two years of high school as unimportant.

State directors of vocational education are having trouble funding the *HSTW* Assessment, which costs about \$30 per student. In most cases, schools assess a sample of students rather than all students who complete a concentration of vocational courses. States need to consider giving an exam, such as the *HSTW* Assessment, at the end of high school to determine whether all students are completing the recommended curriculum and meeting performance goals in reading, mathematics and science.

Oklahoma has invested in the development of end-of-program exams for broad fields of vocational study. The state requires all high schools and vocational/technical schools to give graduating students in occupation-specific programs either a state-developed occupational exam or a state exam that is given for occupational certification. The state provides schools with reports on their performance on the exams. The schools are asked to set goals for improvement. If schools do not improve in a three-year period, they are required to develop a state-approved plan for improvement.

■ **Invest in the development of end-of-program exams for broad fields of vocational study.**

Incorporating technical literacy exams into state accountability systems will improve the quality of vocational instruction in high school. At the end of high school, each student would have to take an in-depth, written exam designed to measure his or her technical literacy skills in a broad occupational field of study. This exam would measure the student's ability to read, comprehend, interpret, extract and analyze information in that field; apply mathematical concepts to solve complex problems encountered in the workplace; and understand major technical concepts in that field.

■ **Increase high schools' discretionary funds to implement research-based school reform.**

Most schools need more funding to get 85 percent of their career-bound students to meet the *HSTW* performance goals. Schools need more money to give teachers in-depth staff development and time to work together in revising their curricula to higher standards.

■ **Develop school-improvement support teams to work with high school reform.**

HSTW sites in most states need more technical assistance and support from outside sources to engage the faculty and the community in making the necessary changes to achieve *HSTW* goals. State support teams — equipped to conduct technical assistance visits and provide ongoing assistance — would place particular emphasis on nonimproving schools.

States spread their staff and financial resources across too many fragmented initiatives to have any significant impact. States need to combine their resources — federal vocational, tech-prep and school-to-work funds as well as other funds — to help high schools make comprehensive, research-based improvements. **State staff who administer these funding programs can form a support team to help schools achieve comprehensive reform that links quality vocational studies and demanding academic studies.**

Challenge 2: Get 85 percent of career-bound students to meet the *HSTW* reading goal.

About half of *HSTW* students do not meet the *HSTW* performance goal for reading, and 38 percent score below basic in reading. (See Table 6.)

Performing below basic means that seniors reading grade-level material cannot relate aspects of the text to its overall meaning, cannot connect ideas in the

Table 6

Career-bound Students' Reading Achievement	Meeting the <i>HSTW</i> goal *	49%
	Below basic	38%
	Basic	46%
	Proficient	16%
	Advanced	0%
	Range of <i>HSTW</i> states' percentages of students meeting the <i>HSTW</i> goal	35% to 66%

* The reading goal is 279. Students who meet the goal can seek and use information from manuals, journals, periodicals and other documents; identify and solve stated problems; and recognize limitations in available information.

text to personal experiences, and cannot draw conclusions. Compared with others taking the assessment, students who perform below basic are less likely to be able to explain a reading selection's main idea or purpose or to be able to use information from the text in supporting a conclusion or making a point. Such students lack the analytical skills needed to advance in an information-centered economy.

By studying school and classroom practices associated with higher reading achievement, state leaders may learn how to increase career-bound students' reading achievement. The *HSTW* Assessment helps to identify practices that contribute to higher achievement in reading. (See Table 7.) These effective practices address three objectives: 1) teaching the right things; 2) creating a culture of high expectations; and 3) engaging students in learning.

Teaching the Right Things

Seventy percent of students who completed the entire *HSTW*-recommended curriculum in 1998 met the *HSTW* reading goal. Of students who completed the English curriculum but not other curriculum requirements, 60 percent met the *HSTW* goal in reading. Only 40 percent of students who completed

lower-level English courses met the goal. Students achieve at higher levels when they take demanding courses that require them to read more and to construct responses to written materials.

Creating a Culture of High Expectations

When higher performance is expected, students meet the challenge. Of students taking the 1998 *HSTW* Assessment, 14 percent were expected to read more than three hours per week outside of class. The average reading score for this group of students was 14 points higher than the average score of students who read less often. Reading achievement was higher for students who were required to read and report on several books during the year and in the summer. Students who completed at least 30 minutes of homework daily also had better reading scores.

Reading achievement is higher among students who set challenging goals for after graduation from high school. Students will aim higher if they have access to a guidance and advisement system that helps all students set goals and determine which courses to take to achieve those goals. **Students who planned further study at either a community college or a four-year college or university surpassed**

the *HSTW* goal in reading. Seventy percent of students who met the *HSTW* reading goal planned further study, compared with about 40 percent of students who did not meet the goal.

The *HSTW* Assessment also confirms long-held beliefs that working too many hours and watching too much television are associated with lower reading scores.

Engaging Students in Learning

Students who prepared major research papers, completed short writing assignments, made oral pre-

sentations, read technical materials and used computers to prepare assignments had higher achievement in reading than students who were not engaged in these challenging activities. Students who frequently were required to select and research a topic and interpret and synthesize what they learned had higher reading achievement. Yet only 20 percent of students completed a short writing assignment once a day or once a week. Students who reported that they were held to higher standards had higher achievement in reading than students who took courses that contained repetitive content.

Table 7

Students' High School Experiences and Reading Achievement	Average reading scores of students who had these experiences	Average reading scores of students who lacked these experiences
Completed the <i>HSTW</i> -recommended curriculum	288	272
Completed the recommended English curriculum	285	271
Read more than three hours per week outside of class	288	274
Read several assigned books outside of class	281	272
Spent 30 minutes or more on homework daily	279	270
Planned to attend a two-year or a four-year college or university	284	269
Worked no more than 15 hours per week	281	275
Watched TV no more than one hour per day	280	275
Did one or two major research papers per year	279	261
Completed short writing assignments frequently	281	268
Made oral presentations several times a year	279	267
Used word processing to complete assignments	280	270
Used computers daily or weekly for vocational assignments	282	268
Read technical materials frequently for vocational assignments	278	274
Took courses that did not repeat content	278	274

Lessons from Private Schools

Another way to evaluate how to improve reading achievement in public high schools is to consider what private schools do. *High Schools That Work* called three private high schools and four public high schools (*HSTW* sites) to gather information on what is expected of students in language arts and how much reading and writing they do. There were startling differences in the expectations at the two types of schools. Many career-bound students in the public high schools read and write very little. The study was not conclusive, but it did suggest that **states should consider researching the expectations at private high schools, high-achieving public high schools and low-achieving public high schools.**

Private high schools create grade-level reading lists for language arts and other academic disciplines, require students to read during the summer and hold them accountable for this work, and establish

common criteria for teachers to use in assessing students' writing. Students enrolled in the college-preparatory/honors curriculum in public high schools do more reading and writing than other students, but standards for the college-prep English curriculum in public high schools are significantly lower than those in private schools. For example, private school students are expected to do a major research paper every year. In many public high schools, a major research paper is not required until grade 11 or 12 for college-prep/honors students; lower-level language arts courses may not require a major research paper at all. (See Table 8.)

State Actions

School and classroom experiences that are associated with higher reading achievement indicate that states should raise standards for the language arts curriculum in high schools, prepare teachers to

Table 8

Reading/Language Arts Expectations in Sample of Private and Public High Schools	Private	Public	
		College-prep	Non-College-prep
Number of assigned books for English	16 to 18	6 to 8	2 to 4
Number of assigned books for other subjects (not including textbooks)	4	0	0
Students read the equivalent of 30 books a year (including journals, articles, research materials, etc.)	Yes	No	No
Required reading list for summer	Yes	No	No
Schoolwide reading list by grade level	Yes	No	No
Major research paper	9th through 12th	11th and 12th	Usually grade 12
Outside writing required weekly	Yes	Varies	No
Schoolwide guidelines for grading writing	Yes	No	No

Source: Telephone survey of three private high schools and four *HSTW* sites

engage students in reading and writing in all content areas, and help schools develop higher expectations for students' reading and writing both in and out of class.

State actions must address the weaknesses of career-bound students, who are less able to explain a reading selection's main idea or purpose and to use information from the text to support a conclusion or make a point. They have difficulty making inferences from material they have read, drawing conclusions and connecting information from texts with their personal experiences. Assignments need to engage them in describing texts' meaning in their own words. Schools too often fail to make this type of assignment to career-bound students.

States can take several actions to engage school board members, district personnel and high school leaders in helping high schools get 85 percent of career-bound students to meet the *HSTW* reading goal. They can communicate to parents and students the expected level of performance, how the performance will be evaluated, and why standards and evaluation are needed. States also can:

- **Require all students to complete four years of college-preparatory English.** The 1998 *HSTW* Assessment showed that more than half of career-bound students still are enrolled in general, basic or applied English courses that are linked with much lower academic achievement. In some schools stu-

dents can meet the English requirements by taking courses such as speech or journalism that should not replace rigorous college-preparatory courses in language arts.

- **Help high schools measure all courses in language arts based on standards such as those of the Council for Basic Education.** The council's standards include all aspects of language arts: reading, writing, communicating, researching and thinking. The reading standards address the amount, variety and complexity of materials to be read. The writing standards address how to write in different forms and styles; how to use grammar, spelling and punctuation; and how to write for different audiences. All of the standards emphasize students' use of higher-order skills such as interpretation, analysis, evaluation, critical reading and research. Standards are aimed at teaching students to be independent learners.

When state standards were compared with the Council for Basic Education standards, only two *HSTW* states — Massachusetts and West Virginia — received a grade of B for the rigor of their English/language arts standards. No *HSTW* state was judged to have “very rigorous” standards for English/language arts.

- **Require high schools to have a reading list for each grade level and to specify the number of books or equivalent materials that students are**

Three years ago, Eastern Guilford High School in Gibsonville, N.C., eliminated low-level English courses and required all students to complete a college-preparatory sequence of language arts courses. Principal Linda Mabe said: “We replaced low-level courses because we thought it was morally and ethically wrong to offer them. We were expecting too little of students and were failing to prepare them for further study and an active role in an information-centered economy.” Students who were not expected to succeed have done well in the more demanding courses. The average SAT score rose from the low 900s to over 1000.

expected to read across the curriculum each year. Such standards will increase the amount and quality of reading.

■ Offer institutes and workshops on the state and local levels to help all teachers learn to incorporate reading and writing. More than 60 percent of academic and vocational teachers at *HSTW* sites in 1998 said they needed staff development on using reading and writing in the content areas. Teachers recognize their weaknesses and are asking for help. States at least should provide staff development

materials and a list of qualified trainers. (See the box below for the types of services schools need to raise student achievement in language arts.)

■ For high schools where many incoming ninth-graders lack sufficient reading skills, require the development of programs to help these students catch up. Summer initiatives, ninth-grade catch-up courses, after-school tutoring and other efforts should be aimed at improving reading achievement and teaching students how to comprehend and interpret reading materials. To prevent future inade-

Technical Assistance and Staff Development Needed to Raise Student Achievement in Reading

States can lead efforts to raise student achievement in reading. The following services particularly are needed:

- Align the language arts curriculum to Council for Basic Education standards.
- Encourage language arts teachers to lead efforts to involve the entire faculty in increasing the amount of reading, writing, analyzing and presenting that high school students do.
- Train all academic and vocational teachers to engage students in reading, writing, speaking, listening and thinking as part of their learning in all subjects. Students need these skills for lifelong learning. Several strategies encourage the inclusion of these skills in all courses:
 - ◆ **Reading lists by grade level** — Require high school students each year to read at least 30 books or equivalent materials, including textbooks, literature, scientific articles and technical documents. Students should comprehend, analyze, interpret, compare and critique works in all subjects.
 - ◆ **Reading and analysis** — Engage all students in reading and analyzing textbooks and other materials daily and in defending their interpretations individually and/or in groups.
 - ◆ **Writing across the curriculum** — Require students to write daily in all classes and to use various styles, including summary, interpretation, persuasion, narration, creative writing and analysis. Grade at least one formal writing assignment per week and require students frequently to do informal, ungraded writing in all subject areas.
 - ◆ **Writing standards** — Get the language arts department to take the lead in developing writing standards.
 - ◆ **Research and presentation skills** — Routinely ask students to gather information and use it to support a particular point of view. They should present this information formally in a research paper or presentation and informally in classroom discussion or debate.

quacies among ninth-graders, schools need to accelerate reading instruction in the middle grades.

■ **As part of the statewide assessment, collect information about high school students' reading habits.** Information about the amount and type of reading students do in language arts courses and

across the curriculum — both in and out of class — can provide baseline information on what is expected of different groups of students. Data linking students' reading experiences with their reading achievement can help principals and teacher leaders discuss with faculty, students and parents what can be done to improve reading achievement.

Challenge 3: Get 85 percent of career-bound students to meet the *HSTW* mathematics goal.

HSTW sites' efforts to raise student achievement are having the best results in mathematics. Fifty-six percent of career-bound students in 1998 met the mathematics performance goal; only 6 percent performed below basic. Forty-five percent performed at the basic level, 46 percent at the proficient level, and 3 percent at the advanced level. (See Table 9.)

Students who score below basic can deal only with addition, subtraction and simple problem-solving with whole numbers. Students who score at the basic level can multiply and divide, perform simple measurements and solve two-step problems. Students at or above the proficient level can reason;

solve problems involving fractions, decimals and percentages; and demonstrate elementary concepts in geometry, statistics and algebra. Students who reach the proficient level are less likely to require remedial mathematics courses in college and can pass most employers' exams for jobs in promising careers.

The percentage of students who meet the *HSTW* mathematics goal in the *HSTW* states ranges from 41 percent to 72 percent. **The state in which 72 percent of students meet the goal requires all high school students to complete Algebra I and geometry. This state also administers an end-of-course exam in Algebra I.**

Table 9

Career-bound Students' Mathematics Achievement	Meeting the <i>HSTW</i> goal *	56%
	Below basic	6%
	Basic	45%
	Proficient	46%
	Advanced	3%
	Range of <i>HSTW</i> states' percentages of students meeting the <i>HSTW</i> goal	41% to 72%

* The mathematics goal is 295. Students who meet the goal understand concepts from algebra, geometry and probability; can apply those concepts to solve multistep problems; and can explain their reasoning in various problem-solving situations.

Too many students who take mathematics do not understand when and why the concepts should be used. Mathematics teachers need to engage students in using mathematics concepts to solve real-life problems.

States can learn how to improve students' mathematics performance by studying school and classroom practices associated with higher achievement. The one element that contributes most to higher student performance in mathematics is the *HSTW*-recommended academic core with a career concentration. **Seventy-five percent of students who completed all aspects of the *HSTW*-recommended curriculum met the performance goal for mathematics.** Of students who completed the mathematics curriculum (but not the reading and science components), 62 percent met the *HSTW* performance goal for mathematics, while only 35 percent of the students who failed to complete the mathematics curriculum met the performance goal in that subject. Completing the mathematics curriculum gave students a better chance of meeting the performance goal in mathematics, and completing all aspects of the recommended curriculum (reading, mathematics and science) improved their chances even more.

Even students who complete the mathematics curriculum may not achieve the performance goals if the emphasis is on covering the material rather than on using teaching methods that enable students to gain deeper understanding of the material. Of the students who did not meet the *HSTW* performance goal in mathematics, 66 percent had completed the recommended curriculum. It is important to ensure both that students take the "right courses" and that these courses are taught in ways that result in students' meeting course standards.

Several other practices contribute significantly to higher achievement in mathematics. These effective practices address three objectives: 1) teaching the

right things; 2) creating a culture of high expectations; and 3) engaging students in learning.

Teaching the Right Things

Students who complete four years of high-level mathematics courses perform better. Of students who met the *HSTW* goal for mathematics, 54 percent completed four or more mathematics courses. Certain courses were especially significant in raising student achievement. For example, 80 percent of students who met the mathematics goal took Algebra II, compared with 40 percent of those who did not meet the goal. Ninety percent of students who met the mathematics goal took geometry; only 60 percent of students who did not meet the goal took geometry.

Students who had learned some algebraic concepts in the middle grades — at least a semester of algebra or pre-algebra before ninth grade — had higher average achievement in mathematics than students who lacked early exposure to algebra.

Students who took vocational classes that required high-level mathematics performed better than other career-bound students. Those who took electronics and drafting and design had average scores at the proficient level.

Creating a Culture of High Expectations

Students who believed they were encouraged to take more mathematics courses and were expected to do well in these courses performed much better than students who said they lacked encouragement. **The mathematics achievement of students in states that have had end-of-course exams in mathematics for**

several years was higher than that of students in other states. Achievement also was greater among students who took mathematics in their senior year.

Receiving extra help to meet course standards was linked with higher performance by students. In contrast, half of the students who failed to meet the mathematics goal said they needed extra help but did not receive it.

Students who received counseling about further study had better average scores in mathematics than those who received no such counseling, and students planning to attend a two- or four-year college or university scored better on average than those with no such plans.

A culture of high expectations affects how students manage their time outside of class. Students who completed at least an hour of homework daily had higher mathematics scores than those who did less homework. Students who watched an hour or less of television daily scored at a higher level than students who watched more TV. Also, students who worked more than 15 hours a week did not perform as well as students who worked fewer hours. The way students spend their time outside of class makes a difference in their academic performance.

Engaging Students in Learning

Students' mathematics achievement improved when teachers encouraged them to talk about mathematics and use it to perform authentic tasks. Students who worked in groups to solve difficult mathematics problems had higher average scores

than students who worked alone. Students who used mathematics daily or weekly to complete assignments in vocational courses had higher average scores than other career-bound students. Scores also were higher for students assigned to work-site mentors than for students who lacked this type of work-site experience.

State Actions

To work toward getting 85 percent of career-bound students to meet the *HSTW* mathematics goal, states should take several actions that are linked with higher achievement by students. States can:

■ **Introduce all students to concepts of algebra and geometry before grade nine.** Programs that introduce middle grades students to these concepts and are taught by qualified mathematics teachers will increase the percentage of career-bound students who meet the *HSTW* mathematics goal by the end of high school.

■ **Require career-bound students to complete at least three years of mathematics after grade eight.** High schools should build on the jump-start students receive in the middle grades by requiring all students to take three mathematics credits in college-preparatory Algebra I and II, geometry or higher-level courses. **High schools with large percentages of low-performing students should require four years of mathematics.** Mathematics achievement is the best predictor of how much students will earn when they are 25 and is a key factor for success in postsecondary studies.

Some High Schools That Work states require all students to complete three mathematics courses, two of which must be equal to Algebra I, geometry or Algebra II. They are Alabama, Kentucky, Ohio, South Carolina, Texas, Virginia and West Virginia. Indiana and North Carolina require these courses for some — but not all — students.

Table 10

Students' High School Experiences and Mathematics Achievement

	Average mathematics scores of students who had these experiences	Average mathematics scores of students who lacked these experiences
Completed the <i>HSTW</i> -recommended curriculum	311	293
Completed the recommended mathematics curriculum	302	283
Completed four or more mathematics credits	304	292
Completed algebra or pre-algebra before ninth grade	305	294
Completed a career concentration in:		
Agriculture	297	Not available
Business	301	Not available
Health	296	Not available
Electronics	304	Not available
Drafting and design	313	Not available
Were encouraged and expected to do well	299	290
Were encouraged to take more mathematics courses	301	295
Lived in states that have had end-of-course exams for several years	307	298
Took mathematics in senior year	300	294
Received extra help to meet course standards	296	292
Received counseling about further studies	299	294
Planned to attend a two-year or a four-year college or university	304	290
Spent one hour or more on homework daily	298	297
Watched TV no more than one hour per day	303	295
Worked no more than 15 hours per week	302	295
Worked in groups to solve problems	299	293
Used mathematics daily or weekly to complete vocational assignments	300	293
Had veteran workers as mentors in work-based learning	302	294

■ **Require seniors to take mathematics.** Students forget a considerable amount of what they have learned if they do not take mathematics in grade 12. To include mathematics in the senior year, schools can spread over two years the last mathematics course taken or can require all students to take one of their high-level mathematics courses in their senior year.

■ **Require end-of-course exams in Algebra I and geometry.** End-of-course exams that measure students' understanding of and ability to apply mathematics concepts and procedures can help improve mathematics instruction and student learning. Many more students are taking these courses, but teachers are not making sure that these students understand the material. Some schools reteach algebra and geometry until students master at least 80 percent of the materials covered in a grading period. These

schools are seeing higher achievement, lower failure rates and improved student behavior. Students are more likely to succeed when they retake a unit rather than receive new materials and fall further behind.

■ **Provide academic and vocational teachers with staff development on mathematics content and teaching methods.** Mathematics teachers want to learn how to help students understand mathematics concepts rather than just memorize a set of procedures. Only 10 percent of mathematics teachers at *HSTW* sites said that in the last three years they have received more than 20 hours of staff development on mathematics content and new instructional methods. However, 46 percent said they needed this type of help. About half of vocational teachers said they needed to upgrade their own mathematics knowledge and learn ways to get students to use mathematics in completing projects.

Challenge 4: Get 85 percent of career-bound students to meet the *HSTW* science goal.

In 1998, 51 percent of graduates from *HSTW* sites met the *HSTW* science goal, 50 percent scored at the basic level, 40 percent reached the proficient level, and 9 percent scored below basic. States' percentages of career-bound students who met the science goal ranged from 38 percent to 64 percent. The state with 64 percent uses an end-of-course exam in biology. (See Table 11.)

Students who score below basic in science understand simple scientific principles. Students who

score basic can apply general scientific information, while students at the proficient level can analyze scientific procedures and data.

By studying school and classroom practices associated with higher achievement in science, state leaders may learn ways to improve students' performance. As with reading and mathematics, effective practices address three objectives: 1) teaching the right things; 2) creating a culture of high expectations; and 3) engaging students in learning.

Springdale High School in Arkansas has had success with requiring ninth-graders to demonstrate that they understand algebra before they move to the next course. Principal Don Love said students' mathematics scores on the Stanford Achievement Test, 9th Edition (Stanford 9), in grade 10 rose from the 53rd percentile to the 66th percentile between 1996 and 1999.

Table 11

Career-bound Students' Science Achievement	Meeting the <i>HSTW</i> goal *	51%
	Below basic	9%
	Basic	50%
	Proficient	40%
	Advanced	1%
	Range of <i>HSTW</i> states' percentages of students meeting the <i>HSTW</i> goal	38% to 64%

* The science goal is 292. Students who meet the goal can apply knowledge, skills and reasoning to interpret scientific and technical data from tables and to make inferences about outcomes of experimental procedures; can evaluate the appropriateness of an experiment's design; and can interpret scientific text and graphs.

Teaching the Right Things

Completing the *HSTW*-recommended academic core and a career concentration is associated with high achievement in science. Achievement also tends to be higher when students:

- complete the *HSTW*-recommended science curriculum;
- complete four science credits;
- take a science course in their senior year; and
- complete two of the following courses: chemistry, physics, anatomy/physiology or college-preparatory biology. Encouraging students to complete high-level science courses is the most promising way to advance science achievement.

Career-bound students with the highest science achievement completed one of four career concentrations: agriculture, business, electronics, or drafting and design.

Creating a Culture of High Expectations

Students in states that have had an end-of-course exam in at least one core science course for several years scored higher on the science portion of the *HSTW* Assessment than students in other states. Students who received encouragement and were expected to do well scored an average of nine points higher in science than other students. Scores were higher for students who had specific plans for postsecondary studies. As with results for mathematics and reading, science scores were higher for students who watched less TV and worked fewer hours.

Engaging Students in Learning

Students whose teachers engaged them in learning activities had higher average scores in science than students who lacked such experiences. For example, average scores exceeded the *HSTW* goal for students who made presentations, prepared written reports on science topics or conducted scientific experiments once or twice a year. Students who did

not have these experiences had lower scores. Students who observed veteran workers in scientific fields during work-site learning experiences also had higher achievement.

State Actions

States can take at least two actions to get 85 percent of career-bound students to meet the *HSTW* achievement goal for science. They can:

■ **Require three science credits, including two in courses such as chemistry, physics or applied physics, anatomy/physiology, and college-preparatory biology.** Students who met the *HSTW* achievement goal for science averaged more than 1.5 credits in these courses, while students who did not meet the goal averaged less than one credit in these courses. Of the 22 *HSTW* states, only Massachusetts, Texas and West Virginia require three science credits that are defined precisely enough to meet this standard. To improve the science achievement of career-bound youths, states should concentrate on teaching fewer science courses and teaching them well, rather than teaching a large variety and numerous levels of courses.

■ **Provide science and vocational teachers with in-depth staff development to upgrade science content and improve their skills at incorporating hands-on activities for students.** Only 18 percent of science teachers at *HSTW* sites said that over the last three years they had received more than 20 hours of staff development to upgrade their content knowledge in science and to teach them new instructional methods. Fifty-five percent said they needed such staff development.

Science teachers who teach courses in scientific fields outside their areas of expertise need to upgrade their content knowledge in those areas. Science teachers also need staff development in helping students plan and carry out experiments to answer questions that interest them.

Vocational teachers need staff development in using hands-on activities in their fields and in integrating scientific concepts into the curriculum. Only 6 percent of vocational teachers said that in the last three years they had received more than 20 hours of staff development in these areas, but more than 47 percent of vocational teachers reported the need for such staff development. This type of staff develop-

Daviess County High School in Owensboro, Ky., has made college-preparatory and accelerated courses the “standard” for all students. College-preparatory English is the lowest English course, and Algebra I is the lowest mathematics course. The 1,645-student school offers more than 20 Advanced Placement courses, with spaces for more than 800 students. All students complete rigorous courses in English, mathematics and science in grades nine and 10 and enter one of six “academies” — schools-within-schools — for grades 11 and 12. The academies cover mathematics/science; liberal arts; human services and wellness; industrial and agricultural technology; business; and mass communication/fine and performing arts. Academic and vocational teachers work together to help students connect academic and vocational studies. “When we eliminated the general track and enrolled all students in high-level courses, we began to see declines in dropouts, discipline problems and absenteeism,” Principal Gary Keller said.

Table 12

Students' High School Experiences and Science Achievement	Average science scores of students who had these experiences	Average science scores of students who lacked these experiences
Completed the <i>HSTW</i> -recommended curriculum	302	287
Completed the recommended science curriculum	297	284
Completed four science credits	300	287
Completed algebra or pre-algebra before ninth grade	305	294
Completed a course in:		
Chemistry	297	Not available
Physics	304	Not available
College-preparatory biology	301	Not available
Anatomy/physiology	299	Not available
Took science in senior year	295	280
Completed a career concentration in:		
Agriculture	294	Not available
Business	293	Not available
Electronics	298	Not available
Drafting and design	304	Not available
Lived in states that have end-of-course exams	299	291
Were encouraged and expected to do well	293	284
Planned to attend a two-year or a four-year college or university	297	284
Watched TV no more than one hour per day	296	289
Worked no more than 15 hours per week	296	290
Made one or two presentations a year on science projects	294	289
Wrote one or two reports in science a year	294	286
Observed veteran workers at work sites	295	288

ment can help vocational teachers strengthen students' abilities to design scientific studies that address key questions in vocational fields; carry out

these studies; and collect, analyze and report on data.

Summary

If states' political and educational leaders share the Southern Regional Education Board's belief that rigorous vocational studies can motivate more students to complete an upgraded academic core, and if these leaders accept the lessons described in this report, **they need to help more schools and students benefit from these experiences.** This effort includes integrating some of the essential practices

from the *HSTW* initiative into state accountability systems and broadening state assessments to link quality vocational studies and challenging academic studies. States need to provide more technical assistance, discretionary funding for site-specific staff development, and time for teachers to upgrade curricula and to learn new ways of engaging students in challenging assignments.

