Career/Technical Courses Meet 21st-Century Standards in Equipping Students for Further Study, Training and the Workplace

More schools are designing intellectually demanding career/technical (CT) courses — aligned with 21st-century requirements — to prepare students for further study, advanced training and work. They are using effective leadership, embedding essential college-readiness standards into CT courses, making CT courses more intellectually challenging, using flexible schedules and settings, and improving communication between the technology center and the high school.

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Using Effective Leadership at the High School, Technology Center and District Levels to Connect CT Studies to Broader High School Reform

Technology Centers Can Take Action to Prepare Students for Work and Further Study

Leadership definitely makes a difference in whether a CT center is successful in preparing students for the dual purposes of work and further study. "The leader drives the learning," said **Gene Bottoms**, senior vice president of SREB.

Technology Centers That Work (*TCTW*) sites where leaders are ensuring that the Key Practices for school improvement are being implemented showed impressive gains between 2008 and 2010. These centers increased the percentages of students meeting the *High Schools That Work* (*HSTW*) college- and career-readiness goals from 42 percent to 56 percent in reading, from 44 percent to 52 percent in mathematics and from 41 percent to 52 percent in science between 2008 and 2010.

These *TCTW* centers are making progress in preparing more students for the future. "SREB data indicate that there is a less than 10 percent chance that students who meet the readiness goals will need to take remedial courses in a community college," Bottoms said. "We know that the likelihood of passing certificate exams also increases when students can read and understand the language of the career field they plan to enter."

Another pathway to improvement in technology centers is to pay attention to the courses that students take. As student achievement has improved, so have the percentages of students taking more rigorous academic courses. The percentages of students completing the *HSTW*-recommended academic core rose from 26 percent to 32 percent in English, from 30 percent to 35 percent in math and from 26 percent to 38 percent in science between 2008 and 2010.

SREB
592 10th Street, N.W.
Atlanta, GA 30318
(404) 875-9211
www.sreb.org

The 2010 *HSTW* Assessment showed that effective teaching and learning occur when:

- goals for teaching and learning are clear.
- the environment is demanding yet supportive.
- directors stress teaching all students to high standards.
- teachers continually learn new ideas and teaching strategies.
- directors and teachers work as a team.
- the center uses data to evaluate the curriculum, instruction and student success.

Two *TCTW* sites are among those demonstrating that they can make a difference for students. Principal **Dan Kerr** of **Hunterdon County Polytech** in Flemington, New Jersey, described positive changes that have occurred at his center as a result of implementing the *TCTW* framework:

- More professional development is offered. Most of it is delivered in-house by faculty and administrators. Teachers work in professional learning communities (PLCs) to develop academic instructional strategies.
- A new grading policy includes the requirement for students to redo work.
- Research-based teaching practices were collected and made available to the faculty.
- English and math teachers were hired to work with the CT instructors.
- Every CT student is expected to produce an end-of-course product or demonstration.
- All CT courses are aligned with outside partners and mentors who support the instructors as well as the students.
- Students use laptop computers to keep journals and complete writing activities. The principal reads the journals and gives feedback to the students.

Bonnie Martinez, principal of **Caddo Career and Technology Center** in Shreveport, Louisiana, gives the following practices credit for students' higher achievement:

- An intense focus on literacy across the curriculum
- An in-house professional development schedule that includes every staff member
- Use of a strategic instructional model in every classroom
- School leaders that are focused on high expectations
- Teachers examining student work regularly
- Support for teachers and students by literacy, numeracy and special education coaches

"Leaders at *TCTW* sites are using data to inform decisions about curriculum and instruction," Bottoms said. "They are embedding research-based practices in literacy and numeracy into the CT curriculum and are incorporating a support system for teachers as well as students."

Contacts:

Gene Bottoms
gene.bottoms@sreb.org

Dan Kerr
dkerr@hcpolytech.org

Bonnie Martinez
bmartinez@caddo.k12.la.us

Five Focus Teams Involve All Faculty Members in Improving a Technology Center

Daniel Morgan Technology Center in Spartanburg, South Carolina, was involved in continuous improvement, but the administration wanted to make sure all faculty members were engaged in the process. Using the *TCTW* framework, the center created five focus teams to address identified school needs and to develop and implement practices to deal with the needs. The center leadership is supporting teachers to take ownership of problems and solutions.

The five teams are data; curriculum, instruction and standards; literacy and numeracy; school climate; and communications. School leaders provided professional development for each group of teachers before they began meeting in 2008-2009. Meetings are held during extended lunch periods once a month.

"This model allows faculty to explore, evaluate and buy into school projects," said Assistant Director **Dennis Nance**. "Focus team members brainstorm, solve problems and share ideas," he said. "The teams ensure that faculty and staff are aware of current and future issues at the center."

Team leaders work with school administrators to define the duties and maintain the focus of each team. After the first year, the duties were reviewed and updated, taking into consideration the input of a *TCTW* Technical Assistance Visit (TAV) team that visited the center.

Each focus team already has made progress in defining school needs and possible solutions:

- **Data —** This team reviewed and recommended improvements in registration data to help students do a better job of selecting the correct career cluster. The team continues to explore the use of data to improve classroom instruction and to increase student achievement.

- **Curriculum, Instruction and Standards —** This group researched, analyzed and developed a curriculum notebook. It reviewed certifications and made suggestions for improvement. It also ensured that course standards are posted in each classroom.
- **Literacy and Numeracy —** Team members reviewed and revised reading and writing strategies for learning. They visited classrooms to observe literacy and numeracy activities and developed strategies to integrate mathematics into every program. The team prepared staff development presentations on how to integrate literacy (reading, writing and speaking) and numeracy across the curriculum.
- **School Climate —** This team reviewed the results of South Carolina school climate surveys and made recommendations to the school leadership team. It also reviewed and expanded the school's parent and community involvement plan.
- **Communications —** After updating the school's public relations plan, this team met with the industrial relations director at the school to inventory the availability of technology to communicate school activities to students, families, business and community leaders, and the public.

"By being involved with a focus team, all staff members can see that school improvement is relevant to them and their students," Nance said. "We have also been able to make real progress in improving all aspects of the school."

Contact:

Dennis Nance
dennisn@dmtc.k12.sc.us

Converting to a Full-Time Technical High School Proves to be a Winner for Students

After converting from a shared-time facility to a full-time comprehensive technical high school, **Sussex Tech** in Georgetown, Delaware, has worked hard to excel in preparing students for college and careers. The efforts have paid off in student achievement and school recognition, including selection as a National School of Excellence, an *HSTW* Pacesetter School and a top 100 high-implementation *HSTW* site.

Enrollment was declining rapidly when the school made an about-face almost two decades ago. There was no academic counseling and no coordination between the academic curriculum and career/technical education (CTE). The school embraced the *HSTW* Key Practices, made other essential changes and now receives more than 700 student applications for 330 available spaces each year.

Students enrolling in the ninth grade enter an exploratory program before selecting a high school major in the spring. The 15 majors are in four clusters: automotive, communications and information tech, health and human services, and industrial engineering. "During the first year of the program, 40 percent of freshmen kept their number one choice, while 60 percent changed their minds," Superintendent **Pat Savini** said. "There have been few if any changes in majors in recent years."

Every senior is required to complete a major project that includes a written research paper, a product and an oral presentation. This exhibition of mastery challenges students with rigor and authentic assessment of cumulative learning.

Ed Dougherty, special education teacher, works with other teachers to coordinate support services that have proven effective in helping all students advance. The graduation rate for special education students is 96 percent.

The support services at Sussex Tech include:

- home visits.
- freshman orientation, including motivational speakers and opportunities to meet teachers and students, two days before upperclassmen arrive.
- "Techademic" coaching available to students in academic and CT courses several nights a week.
- on-site day care services provided by Sussex Tech students.
- a wellness center.
- mainstreaming special education students into most classes.
- a discipline, security and intervention specialist to work with at-risk students in a non-disciplinary environment.

Teachers share 40 minutes of common planning time at the beginning of each day. They prepare lessons to teach in the school's block schedule and work together to integrate academic and CT studies.

Dougherty summed up the changes at Sussex Tech this way: "Collaboration among teachers and staff has created an educational environment that is spontaneous and contagious. We have accomplished our mission and continue to strive for improvement."

Savini said, "Converting a shared-time center into a full-time comprehensive technical high school is not an easy task and presents many challenges, but if you hang your hat on what's best for students, your focus will be clear and your efforts worthwhile."

Contacts:

Pat Savini
psavini@sussexvt.k12.de.us

Ed Dougherty
edougherty@sussexvt.k12.de.us

Embedding the Essential College-Readiness Standards for Reading, Mathematics and Science into Career/Technical Courses

Students Can Learn to Read Productively in Career/Technical Courses

"The correct practices before, during and after reading will help students develop into independent readers, lifelong learners and full participants in the learning process."

Marc Acuna
Flowing Wells High School

Contacts:

Rebecca Hurst
hurstr@flowingwells.k12.az.us

Marc Acuna
acunam@flowingwells.k12.az.us

How would you like to be the only person on a roller coaster with a white-knuckle grip on the safety bar while others throw their hands in the air and shout with excitement? When the coaster comes to a stop, you have taken the ride but haven't participated fully in the experience.

That's how it is for less-than-proficient readers in CT courses, according to **Rebecca Hurst**, English department chair, and **Marc Acuna**, CT instructor, at **Flowing Wells High School** in Tucson, Arizona. Career/technical education requires technical reading beyond the scope of the classroom.

Hurst and Acuna maintain that it is not enough for CT students to comprehend the text; they must "train their brains" to use the patterns of thinking appropriate to various subjects and situations. "Students must be guided, coached and then allowed to take ownership of the reading process," Hurst said.

"Students need to be taught how to approach reading, how to connect with the reading process and how to evaluate their own reading comprehension," she continued. "Simply answering questions after reading is a disconnected process that usually yields only lower-level thinking and learning."

Because teachers often are perplexed about how to incorporate reading into CT courses, Hurst and Acuna have written a booklet titled "…*But I Don't Teach Reading: Teacher-Friendly Student-Efficient Reading Strategies for the CTE Environment*." (The booklet is available from Hurst or Acuna at their e-mail addresses.)

The reading strategies that Hurst and Acuna recommend to their colleagues fall into three categories: before, during and after.

- **Before reading —** Establish connections and help students determine the purpose of reading. Lay the groundwork for learning and create predictive behaviors. Tap into students' "adolescent arrogance" or "compelling need to argue" to prove they are right. Some before-reading strategies include anticipation guides, word splashes, vocabulary squares, concept circles and block-outs.
- **During reading —** Teach students to establish a thinking pattern specific to the subject matter. Check for understanding, question and verify connections, and establish "systems thinking" behaviors. Strategies such as picture-in-picture sheets, flip sheets, graphic organizers, critical sustainability inquiries and adapted reciprocal readings will assist students as they read.
- **After reading —** Students need strategies to review key concepts, make connections, analyze organizational structures, predict further outcomes or impact, and establish a framework for implementing new ideas. Strategies include graffiti boards, alphabet races, cognition sheets, implementation plans, concept/process trees, spatial analogies and block-outs.

According to Hurst and Acuna, nothing beats reading and writing to develop students' reading and writing skills. "The correct practices before, during and after reading will help students develop into independent readers, lifelong learners and full participants in the learning process," Acuna said.

Hurst and Acuna believe reading strategies should do more than help students understand the content; they should help students apply what they have read in practical settings. One Flowing Wells High School senior who had used several reading strategies in various classes throughout the day said, "These strategies must not be real, because they are too easy and don't waste time. They make us work with the content instead of repeating things over and over again." It is the "work with it" that connects the classroom to the outside world and increases retention, Hurst and Acuna pointed out.

Flowing Wells High School is an Arizona Highly Performing School. **"Widespread use of reading strategies, focus on relevant curriculum and practical applications of content information have helped us improve from a school that had never scored above the state average on the ACT to a school that now boasts a 14 percent advantage over the state in composition, a 10 percent advantage in social studies and a 1 percent advantage in biology,"** Hurst said. "The school has exceeded the state on the Arizona reading test in four of the past five years. Students continue to improve on common finals and to expand their interest in challenging courses such as bio-tech, drafting and advertising."

Aerospace, Math and Science — Fun and Challenging for Technology Students

Students in the pre-engineering academy at **Francis Tuttle Technology Center** in Oklahoma City, Oklahoma, are learning on deeper levels by completing interesting, challenging projects rather than simply seeing and hearing new information.

Instructors **Charles Koutahi** and **Julia Utley** of the academy, in conjunction with **Art Waldenville** of **Moore Norman Technology Center** in Norman, Oklahoma, developed five modules and a research project to make STEM (science, technology, engineering and mathematics) learning more exciting and meaningful for high school students. The modules focus on various aspects of unmanned aerial vehicles (UAVs) such as the BlimpDuino autonomous blimp — an example of which was actually built from a commercial kit at Francis Tuttle. The six-foot vehicle is powered by a remote-controlled electric motor.

The Francis Tuttle pre-engineering academy enrolls 130 students who come from their sending or home schools for three hours either in the morning or in the afternoon each day. Francis Tuttle serves 10 public schools in the six school districts of Crescent, Deer Creek, Edmond, Millwood, Putnam City and Western Heights.

"We are getting students to wrap their minds around a concept rather than just answering a problem on paper," Koutahi said. "We're not teaching different subjects; we're just teaching the subjects in a different way."

The developers of the modules had the support and cooperation of the Oklahoma Aerospace Institute and students in the pre-engineering academy in designing hands-on approaches to learning. Each module contains background information, career cluster knowledge and skills, performance elements, state learning standards and assessment methods.

The research project is based on developing an understanding of UAVs in terms of past history and future advancement in the aerospace field. It is applicable for students in grades 10 through 12 who are interested in becoming engineers, technicians and computer programmers in this rapidly growing field.

There are five UAV modules for students in grades 10 through 12:

- **Linear programming —** determining the rate of gas depletion in order to develop a mathematical model
- **Minimum flight path —** determining the flight path with the minimum distance traveled
- **Fluid mechanics —** a study based on Newton's first law of motion and Archimedes' principle of buoyancy
- **I-D motion —** based on a study of motion along one dimension (kinematics), which leads to Newton's second law
- **Math model through regression —** uses regression to find a mathematical model representing points of data

"We are expanding our students' horizons by getting them to believe that a future in aerospace is within their reach," Utley said.

The average composite ACT score of pre-engineering seniors at Francis Tuttle (from a variety of school districts and socioeconomic backgrounds) was 26.86 in 2010.

Contacts:

Charles Koutahi
ckoutahi@francistuttle.edu

Julia Utley
jutley@francistuttle.edu

Teaching Integrated Science to Career/Technical Students

"The goals of the integrated science initiative are to address students' science credits, advance students' science skills, improve their understanding of science within their trades, increase their motivation to learn, improve their reading and writing skills, and prepare them for postsecondary education and the job market."

Noah Smith
Ulster BOCES Career and Technical Center

Noah Smith is increasing the science knowledge of juniors and seniors at **Ulster BOCES Career and Technical Center** in Port Ewen, New York, both directly as a science teacher and by supporting other teachers in making science more relevant to their students. BOCES — Boards of Cooperative Educational Services — provide instructional and support services to many New York schools.

Smith has developed an array of materials to help teachers and students as they conduct science investigations in CT classes. The materials include a planning guide, descriptions of possible integrated science programs, a sample science investigation report, possible subjects for CT areas and a lesson flow sample.

Students at Ulster Career and Technical Center must complete a science project each year for one-half credit annually toward graduation requirements. Ninety-one percent of the 710 students who took science with Smith in 2009-2010 passed and earned credit. "Students need this credit as a third science unit for graduation," Principal **Genna Suraci** said. "If students earn the credit, most of them go ahead and graduate."

"The goals of the integrated science initiative are to address students' science credits, advance students' science skills, improve their understanding of science within their trades, increase their motivation to learn, improve their reading and writing skills, and prepare them for postsecondary education and the job market," Smith said.

Smith uses digital folders to keep track of 1,100 students from eight school districts studying 28 different CT areas. He visits individual technology classes to present integrated science units in conjunction with the classroom instructors. "Students receive unit credits for both career/tech education and science," Smith said.

Smith offers several types of science programs. He asks teachers to choose a program and let him know their needs in advance so he can plan, order supplies and meet with them to develop the best programs for their classes.

- **Science investigation —** Students examine a problem or concept and generate a workable hypothesis that they test in a constructed science investigation. Then they produce a science lab paper. "When all of the components are combined, the students have a final project that incorporates a career/tech discipline, science and technical writing," Smith said.
- **Senior project and science investigation —** This program is similar to the first example (above) but is expanded and requires a research product and presentation. Lasting for one semester or a year, the project includes a concept and developmental stage, research, a test and production stage, and a report and presentation stage.
- **Enriching the trade —** The idea behind this program is to provide a series of presentational and hands-on short labs at least twice per quarter. Students expand their knowledge of a CT area and build basic science knowledge needed for the trade. Before undertaking the mini-labs, students learn about lab safety and how to write a lab report. "The lab reports help me assess the students and provide credit proof for their home schools," Smith said.

Contact:
Noah Smith
nsmith@ulsterboces.org

- **Pull-out science —** Students designated for science credit are pulled out once or twice a week as needed. Instructors concentrate on building and advancing students' understandings of science concepts within their trade areas.

Smith provides these suggestions for integrating science into CT courses:

Auto Collision Technology — a science investigation of a rusted car hood; looking at various protective coatings; a project involving basic electricity, magnetism and electric motors; and recycling

Aviation — weather formation and reaction rates

Cosmetology — lab investigation and a five-page paper on *E. coli* and *B. cereus* and the effects of sanitizers

Criminal Justice — a CSI-style criminal investigation followed by six labs and a written conclusion

Culinary Arts — muscles and pH

Early Childhood Education — a bacteria and hand soap investigation ending with a written five-page science study

Electrical Construction — a study of basic electrical theory, magnetism, Ohm's law, circuits and solar panels

Fashion and Design — a study of fiber science and the "green" movement

Heating, Ventilation and Air Conditioning — temperature, heat and transfer, gas laws, phase changes, basic electricity, and magnetism

Welding and Metal Fabrication — electricity and magnetism, induction, and tempering steel

"Since Mr. Smith teaches the scientific method to all students in all of our programs and tailors the method to the curriculum of each trade, our students see the usefulness of the applied experiments and receive reinforcement for the concepts taught by the trade teachers," Suraci said.

Engaging Students in Learning by Connecting Science and Career/Technical Education

Science is an integral part of many CT fields of study, and knowing the practical aspects of science can help students learn concepts that might otherwise be difficult to comprehend in their science courses. With the mutual benefits of science and CT integration, it is no wonder that science and CT teachers are seeking ways to collaborate in their instruction.

Larry Rainey, an educational consultant from Cottondale, Alabama, has had more than 35 years of experience teaching at the middle grades, high school and college levels. His observations and ideas are helping teachers work together to blend science and CT studies as a way to raise student achievement and to interest more students in learning.

To begin, Rainey offers seven tenets of good science instruction:

- Science teaching should be active versus passive — in other words, fun.
- It should be hands-on and investigative, allowing students to design experiments to test their hypotheses.
- It should be engaging (as in cooperative learning) and effective.
- It should place the concrete before the abstract. "Science is abstract by nature, so we need to find concrete models for teaching it," Rainey said.
- Less is more. Don't try to teach everything.
- Involve alternative assessment strategies.
- Create cognitive dissonance. Get students to ask questions and think.

Rainey demonstrates how common household items such as drinking straws can be used to illustrate complicated science concepts. He encourages students to make predictions before trying the activities and then use their experiences to explain what happened. "Teachers can find lab activities online to make science an open-ended and interactive experience," Rainey said.

In *Invitations to Science Inquiry*, author Tik Liem gives examples of how to engage science students through "discrepant events" in which the results of a science experiment are different from what the students expect. Rainey advocates using this method to attract more students to science.

The following approach can be used when science and CT teachers plan cooperative units, Rainey said:

- Identify common areas of instruction (content and process skills).
- Using national science standards and the curriculum guide for the CT course, move from the big idea to specifics. For example, the energy efficiency of a house is both science-related and has a practical application.
- Find common planning opportunities to support each discipline.
- Identify one or two areas of initial collaboration and expand in the future.
- Focus on win-win scenarios where both teachers benefit.

Collaborative Projects

Rainey offered examples of collaborative projects, including a yearlong pond project in Mabank, Texas, involving students from biology, chemistry, physics, mechanical drawing and surveying; a house project in Pasadena, Texas, in which physics, physical science, earth science and construction students worked to design a better roof structure after a hurricane in the area; and a schoolwide project in Lubbock, Texas, in which students built a playhouse that they auctioned off for charity. Students participated from the areas of physics, construction, electrical trades, mechanical design, early childhood education, interior design, carpentry, accounting and business.

"Dr. Howard Barrows of Southern Illinois University developed a program using real-world problems from actual medical case studies as a teaching method to engage students," Rainey said. "His goal was to recruit more rural students into the medical field to serve rural areas. The college model is the basis for units that have been developed for high school students."

In the Barrows model, students are given progressively more responsibility for their own learning. The goal is for students to become independent learners with the teacher as a facilitator. "It was determined that the program enhanced the development of problem-solving skills and resulted in students learning the content related to the case studies," Rainey said.

Contact:

Larry Rainey
larryrainey@juno.com

Technology Center Provides a Pre-Engineering Program for High School Students

The pre-engineering program at **Tulsa Technology Center** (Tulsa Tech) in Tulsa, Oklahoma, serves more than 500 students from nine comprehensive high schools in the area. The program is designed to prepare students for engineering studies at a college or university and to demonstrate the importance and relevancy of mathematics and science necessary to complete a postsecondary engineering program. In 2010 the Tulsa Tech program was recognized as one of only 10 "model" programs out of 3,500 nationwide that offer the Project Lead The Way (PLTW) curriculum.

"We studied several programs before choosing Project Lead The Way," said Tulsa Tech Director **Kent Inouye**. "We like Project Lead The Way because it is a nonprofit organization that revamps a nationally standardized curriculum regularly. We feel that PLTW students have a much greater postsecondary retention rate — 75 percent, compared with only 30 percent of regular pre-engineering students — and greater postsecondary persistence."

An Engineering Academy at Tulsa Tech provides the structure to offer pathways with multiple entry points. It is designed to involve students early in their high school experiences. Specific PLTW introductory courses for ninth- and 10th-graders are offered at the feeder high schools. Students then complete the PLTW courses at Tulsa Tech in the 11th and 12th grades.

Through a memorandum of understanding, the host high school provides space, administrative support and custodial services; Tulsa Tech provides everything else — qualified and certified instructional and administrative staff, student services, recruitment and marketing, and funding to develop and deliver programs.

School Relationships

Leaders and teachers at Tulsa Tech build relationships with feeder school principals and counselors to assist students with their class schedules. Students can replace two required credits in a foreign language with two credits earned by completing the PLTW foundation courses. "This has been a key in enabling more students to complete one of several engineering pathways," Inouye said.

Students are expected to complete a rigorous program of academic courses. Tulsa Tech offers pre-calculus, Advanced Placement (AP) Calculus AB and BC, and AP Physics B.

Tulsa Tech currently has 13 pre-engineering teachers, half of them with engineering backgrounds and all ranked as highly qualified in mathematics or science. "It is important for our teachers to develop relationships with math and science teachers at the partner high schools," Inouye said.

Recruitment and marketing are important to the success of the program. Tulsa Tech leaders created a recruitment team and developed a DVD titled "Growing Our Own Engineers" that highlights the program, the opportunities for postsecondary education, and the enjoyable and stimulating aspects of studying engineering.

All interested students and parents are given a tour of any of the pre-engineering sites to observe firsthand the exciting and challenging opportunities available in the program. Parents and qualified students sign an educational plan of study and attend a program orientation.

Sixty-one students graduated from the program in 2010; all of them are pursuing engineering in college, both in and out of state.

"We feel that PLTW students have a much greater postsecondary retention rate...and greater postsecondary persistence."

Kent Inouye
Tulsa Technology Center

Contact:

Kent Inouye
kent.inouye@tulsatech.edu

Making Career/Technical Courses More Intellectually Demanding to Develop Students' Creativity, Inventiveness, Entrepreneurial Skills, Digital Literacy, Cultural Awareness, Adaptability and Personal Skills

Ten Actions to Improve Career/Technical Studies at Your School

The business management book *Good to Great* by Jim Collins brings to mind a question for CT educators: What does it take to go from a "good" program to a "great" one?

SREB school improvement consultant **Joanna Kister** answers the question by providing 10 actions to improve CT studies.

1. **Update programs of study to include sequences of academic and CT courses to ensure that students are ready for college and careers.** An effective program of study begins no later than grade nine and continues through at least two years of postsecondary education. The program of study should culminate in a certificate, a credential, and/or a two- or four-year degree. The four essential ingredients of a career pathway are:
   - a challenging academic component with college-prep English, mathematics, science and social studies;
   - a demanding technical component with industry-related knowledge and skills;
   - a work-based learning component with opportunities for internships, apprenticeships and school-based enterprises; and
   - supplemental services such as counseling and extra help to ensure student success.
2. **Develop power standards based on industry or state CT standards.** Power standards are a limited set of learning objectives, not the total curriculum. Teachers should develop a matrix showing the technical power standards and the technical literacy standards (reading, writing, math and science). The criteria for power standards are endurance (skills and knowledge needed over time), readiness to move to the next level, leverage for understanding other knowledge and skills, and standards-based for academic and technical content standards.
3. **Update the course syllabus.** Include a course description, an instructional philosophy, course goals and power standards, major projects and assignments, and an assessment plan. A course syllabus communicates high expectations to students and parents. It outlines teachers' assignments and how students' grades will be determined. The syllabus should reflect academic, technical and employability standards.
4. **Develop essential questions to organize instructional units or lesson plans.** Essential questions engage students in the types of real-life applied problem-solving that they will need for success in the world of work. They require students to draw from content knowledge and personal experiences. Open-ended and provocative, essential questions turn students into "investigators." *Ask yourself*: How often do I use essential questions for unit and lesson planning?
5. **Require students to read technical materials in their career fields weekly, and teach comprehension strategies.** SREB recommends an across-the-curriculum emphasis on literacy. Instruction for comprehension should focus on teaching students to summarize, paraphrase, categorize, infer, predict, and recognize academic and technical vocabulary. *Ask yourself*: Does my course have a reading list? How much technical reading are students required to do? What reading comprehension strategies do I use on a regular basis?
6. **Require students to write in the language of the career field weekly.** Every classroom should include three types of writing: writing to learn, writing to demonstrate learning and authentic writing. Authentic writing includes business letters, business plans, proposals, brochures, website narratives, bids, how-to manuals, memos, résumés, e-mails and speeches. *Ask yourself*: How often do students write in my classes? How often do I require open-ended responses on assessments?
7. **Require students to solve contextual math problems weekly.** Begin by identifying math problems embedded in the CT program. The CT instructor will assess students' math awareness and help them work through embedded examples. The math teacher will work through traditional examples. The CT and math teachers will work together to teach related contextual examples. Students will demonstrate understanding in both CT and math classes. *Ask yourself*: How many math problems do I assign in a career course per week? Am I familiar with state and national math standards? Have I analyzed problems from the state math assessment? How often do I meet with a math teacher?
8. **Use problem- and project-based learning to design a course.** *Problem-based learning* begins after students receive an ill-structured problem. In the real world, information may be incomplete or conflicting. There is no single way to find the solution. Students observe, interview, search for information, and develop and verify hypotheses in the process of solving a problem. In *project-based learning*, students are assigned a real-life role that requires them to research, develop and present a solution to a problem or perform a task. The project should include six components: authenticity, academic rigor, assessment, active exploration, applied learning and adult connections. *Ask yourself*: To what extent do I use problem-based learning? What major projects do I require students to complete?

9. **Create challenging assignments that help students achieve proficient levels of work.** *Basic assignments and questions* require students to recall facts; make simple inferences or interpretations; and demonstrate some understanding of terminology, principles and concepts underlying the career field. *Proficient assignments and questions* require students to use analytical skills, draw reasonable conclusions, and make appropriate conjectures or inferences by applying logical reasoning on the basis of partial or incomplete information. *Advanced assignments and questions* require students to formulate generalizations, synthesize ideas and create models through probing examples and counter-examples. *Ask yourself*: At what level are most of my assignments and assessments? What do I need to do to take them to the next level? Have I collaborated with other teachers to look at students' work?

10. **Assess both academic and CT standards.** CT instructors face the dual challenge of assessing both technical skills and applied academic knowledge. Assessments should include a variety of strategies, including traditional tests, problem-based questions, scenarios and case studies, projects, presentations and portfolios. All CT courses should have an end-of-program technical assessment that meets SREB-recommended criteria. The assessments should be standardized, independently graded, knowledge-based and available nationally. They also should provide a recognized credential and demonstrate employer relevance. *Ask yourself*: What types of assessments do I use? How often do I use them, and how often do I want to use them? Do technical assessments meet the SREB criteria?

Contact:

Joanna Kister
jkister@pageville.com

Model Automotive Academy Integrates Academic and Career Courses

The **Anderson County Automotive Career Academy** (ACA) has been named the first "model academy" by the Tennessee Council for Career and Technical Education. As part of the **Anderson County Career and Technical Center** (ACCTC), the academy focuses on boosting students' academic and technical skills. ACCTC is a shared-time facility serving students from two sending high schools — one adjacent to the center and the other approximately five miles away.

"All of our academy classes are taught at the honors level. We do everything we can to relate the academic content to the automotive curriculum."

Tim Parrott
Anderson County Schools

Contact:

Tim Parrott
tparrott@acs.ac.

When the center designed the automotive academy three years ago, it focused on providing more than technical skills. "People said the skills attainment of our students was good, but mechanical skills alone are no longer enough," said **Tim Parrott**, director of career/technical education for Anderson County Schools. "We wanted career-oriented students to learn more academic skills."

The automotive academy includes two academic teachers — English/language arts and mathematics — and two automotive instructors. It enrolls 50 students.

Students must apply and be accepted to the academy. The application process takes into consideration students' attendance, behavior and grades and includes an interview with students and parents.

"All of our academy classes are taught at the honors level," Parrott said. "We do everything we can to relate the academic content to the automotive curriculum." In English/language arts, students read literature related to automotive technology. In mathematics, students complete a project in which they analyze the characteristics of racing cars and compile data into a matrix.

Students begin the academy in the second semester of the sophomore year. **Sophomores** attend the center full time and complete Technical English II and Technical Geometry in addition to automotive courses. **Juniors** attend classes at the center in the morning and return to their home high schools in the afternoon. They complete Technical English III and Technical Algebra II in the automotive academy. **Seniors** take classes at the center for part of the day and then either go to an internship or return to the home high school if they need more courses. Many seniors are placed with local car dealers or other automotive businesses. This schedule allows them to prepare for a range of postsecondary options. "We want students to be lifelong learners," Parrott said. "When students leave, we want them to have a credential, postsecondary credit or both."

Students can earn postsecondary credit through dual enrollment courses. They also can transfer credit earned on comprehensive exams to the automotive program at the local trade school. The ACA has articulation agreements with the Tennessee Technology Center and the Universal Technical Institute, which allows students who complete the program and pass comprehensive exams to transfer hours at no cost.

The first class to enroll in the academy graduated in spring 2010. Nine of the 12 graduates were employed in the automotive field upon graduation. All academy sophomores met the proficiency standards on the state's Gateway English assessment. All but one of 34 students passed the Gateway biology exam, and all but two passed the Gateway algebra exam. All 11th-graders scored at least 4 out of 6 on the Tennessee Comprehensive Assessment Program (TCAP) writing exam.

Parrott said the center learned some important lessons in designing and implementing the automotive academy:

- **Develop a set of standardized procedures and a handbook.** "When we started, we had a great idea but no action plan," Parrott said. "For example, some students decided in the 11th grade that the program was not for them, but we lacked standards and procedures to accept new 11th-graders to fill the program."
- **Ensure that students understand the importance of all high school classes.** "We know when students are doing well in the academy, but what happens when they return to the home high school?" Parrott said. "We really stress the need for students to succeed in all of their classes — at the high school and in the academy."
- **Have a recruitment plan.** "The academy has not had an onslaught of applications yet because we are just beginning to get our feet wet with recruiting," Parrott said.
- **Support teachers with professional development.** "The hardest part of integrating academic and career/tech learning was to convey the career/tech content in the math classroom," Parrott said. "It wasn't as difficult for the career/tech teachers because they were already teaching much of the academic content."

Parrott believes the automotive academy has raised the rigor and relevance of all programs at the career center. "When one class is popular because it's easy, a lot of students want to take it," he said. "But if all courses and programs are rigorous, students will choose classes based on their interests and goals. The academy is just one program, but the concept has spread to all classes at the center."

Tennessee Implements a Rubric to Measure Career/Technical (CT) Students' Performance

The Tennessee State Department of Education, Division of Career and Technical Education, is entering the first year of implementation following two years of piloting a rubric to assess the performance of CT students. The Tennessee Career and Technical Education Competency Attainment Rubric, which uses Webb's Depth of Knowledge (DOK) as a framework, defines a "Proficient student" based on workplace and postsecondary readiness standards.

Gay Burden, director of secondary to postsecondary transition for the state department of education in Nashville, lists the following purposes of the rubric:

- To facilitate student progression through a program of study
- To facilitate the progress of students into industry and/or postsecondary education
- To increase the reliability and validity of competency checklists
- To increase teacher consistency in using competency checklists and rating student competencies
- To generate electronic data to measure success that can lead to instructional change

The rubric is a cumulative assessment of student achievement in the following categories: knowledge attainment, technical skills, problem-solving, career awareness and communication/literacy. The levels of achievement are Advanced (4), Proficient (3), Basic (2) and Below Basic (1). Teachers use the rubric to work together in tandem with the Tuning Protocol to examine lessons and student work according to the rubric indicators.

"Schools using the rubric in the pilot program reported increased instructional rigor and greater alignment of content with the rubric indicators," Burden said. One teacher said, "The rubric, along with the Tuning Protocol, has helped me define mastery and provide consistency in my instruction."

CT pilot teachers received professional development on using the rubric and a Rubric Vocabulary and Word Wall for their students. "It is essential to familiarize students with the rubric and with the meaning of mastery," Burden said. To support implementation this year, teachers are participating in a train-the-trainer model combined with regional trainings and webinars.

During the 2010-2011 school year, teachers are receiving benchmark pieces of student work and examples of mastery-level work for use with their students. Based on Michael Fullan's three-tier change process, three to five years will be necessary to institutionalize the rubric following the current implementation year.

"The rubric will be valuable to schools, school districts and state departments of education that are focusing on how to improve career/technical education and competency mastery leading to higher student achievement in career/technical fields," Burden said.

Contact:

Gay Burden
gay.burden@tn.gov

Creating Partnerships of Career/Technical Teachers and Their Academic Colleagues

When challenged by their principal to raise students' literacy and numeracy skills, CT instructors at **Harding High School** (HHS) in St. Paul, Minnesota, rose to the occasion. They reached out to their academic colleagues and subject-specific coaches in an effort to develop meaningful lessons that incorporated reading, writing and mathematics concepts into career courses.

HHS is a Title I school. More than half of its 2,000-plus students are English-language learners.

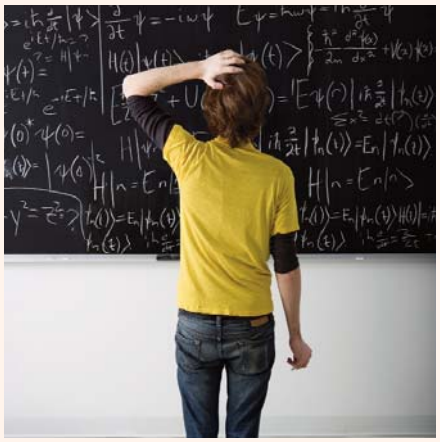
All HHS professional development activities for an entire year focused on literacy strategies facilitated by a literacy coach. Meeting as teams throughout the year, core and non-core teachers shared their classroom experiences.

Sharon Stone, former family and consumer sciences instructor at HHS, worked with both the literacy coach and the math coach to expand the use of reading, writing and math in a culinary arts class. For example, she asked the math coach to observe a lesson on nutrition and caloric calculation in the first period. In the next period, the math coach used an algebraic equation to teach the calorie calculation portion of the lesson. The teacher and the coach debriefed and the teacher modified the lesson slightly. In the third period, the math coach observed and assisted the teacher as she taught the lesson, which reinforced what students were learning in algebra.

Numeracy strategies for family and consumer sciences students included a math bell-ringer on how many grams of protein a student needs in relation to his or her weight in kilograms.

The HHS literacy coach worked with all CT teachers to improve the teaching of reading and writing in connection with CT studies in the classroom. Here are some literacy strategies for CT teachers as practiced at HHS:

- Before students read either aloud or independently, the class reviews new terms and discusses what they already know about the topic.
- Students write a new word, its definition and its antonym in their journals. They then draw a picture of the word to reinforce it in their minds.
- Students write autobiographies describing how many books per year they read and the magazines and newspapers they read. The autobiographies give the teacher insights into students' reading and writing skills.
- Students write and perform a public service announcement on kitchen safety or food-borne illness prevention.
- Working with a partner, each student finds a vocabulary word that could be used in a classroom, shop or lab. Students define their words both literally and in the context of a career and use them in sentences to demonstrate their use in a career field.



"The percentage of reading scores at the Proficient level on the Minnesota Comprehensive Assessment was higher than the district average, and math scores at the Proficient level matched the district percentage."

Sharon Stone
SREB

Contact:
Sharon Stone
sharon.stone@sreb.org

"Harding High School made Adequate Yearly Progress (AYP) in all areas except special education after beginning the emphasis on literacy," Stone said. "The percentage of reading scores at the Proficient level on the Minnesota Comprehensive Assessment was higher than the district average, and the math scores at the Proficient level matched the district percentage."

Stone, now a school improvement consultant with SREB, offers these suggestions for CT teachers in collaborating with their academic colleagues:

- Stay positive.
- Develop working relationships with one or two core content teachers.
- Ask the core content teachers to be consultants for your classes.
- Reciprocate, acknowledge, appreciate and remember to say "thank you."

Marketing Instructor Makes a Career/Technical Assignment More Intellectually Demanding

Nanner O's…DinoRoars…Rainb-O's…Apple Whoppers… Lost Eskimo. What cereal was on your breakfast table this morning?

Darrin Baird's marketing students at **Jellico High School** in Jellico, Tennessee, develop and market their own cereals in a challenging assignment that aligns with state CT standards and adds rigor to projects and assessments. While teaching the promotional techniques that work with today's consumers, the assignment also serves to strengthen students' literacy and computer skills.

Jellico High School is part of the Campbell County school district, where aligning instruction and assessment with high-level standards and objectives is a critical part of increasing educational rigor. The Career and Technical Education Division of the Tennessee Department of Education has made Webb's Depth of Knowledge (DOK) the foundation for its new Career and Technical Education Competency Attainment Rubric.

Developed by Norman Webb of the Wisconsin Center of Educational Research at the University of Wisconsin, the DOK wheel represents the degree of depth or complexity of knowledge required by standards and assessments. Its four components are Level One (recall), Level Two (skill/concept), Level Three (strategic thinking) and Level Four (extended thinking).

Baird's marketing students take their learning to Level Four (extended thinking) in applying a technical vocabulary to design a marketing campaign that includes promotional devices such as premiums, slogans and jingles. Whether students market Apple Whoppers as "a whopping good way to start your day" or Rainb-O's as a way to "brighten up your day," they go beyond the textbook to develop hands-on knowledge of how the marketing process works in the real world.

Combining marketing and agriculture, students use technology such as word processing, spreadsheets and presentation software to complete specific tasks:

- Define marketing and describe the four Ps of marketing — product, price, promotion and place.
- Conduct market research with children and parents and produce a report (on a spreadsheet).
- Create a new cold cereal.
- Develop a slogan, a logo, a brand name and a company name for the cereal.
- Use the AIDA formula — attention, interest, desire and action.
- Create the front and back of a cereal box (using desktop publishing software).
- Create a television commercial as a slide show (using PowerPoint).

Baird uses the Tennessee Career and Technical Education Competency Attainment Rubric to grade the overall project. The levels are Advanced (4), Proficient (3), Basic (2) and Below Basic (1) in five areas: knowledge attainment, technical skills, problem-solving, career awareness and communication/literacy.

Contact:

Darrin Baird
bairdd1@k12tn.net

Using Five Areas of Evaluation to Decide When to Close a Career/Technical Program

Schools want their CT students to be enrolled in viable programs leading to success in college and careers. In Missouri, the **Special School District of St. Louis County** developed a system to ensure that its CT programs are high-quality and relevant to students' needs now and in the future.

The district established a seven-member committee composed of superintendents, teachers and business representatives. After meeting numerous times to research other models, the group designed a PSI (Program Status Indicator) score card that focuses on five areas of career/technical education: placement, advisory committee, enrollment, certification and occupational outlook.

- **Placement —** This area involves reviewing a combination of job placement and postsecondary placement. Positive Missouri School Improvement Program (MSIP) placements include students who are 1) working in their field of study or a related field, 2) continuing postsecondary study, or 3) entering the military. Data are obtained from follow-up surveys of the previous year.
- **Advisory Committee —** The Missouri Workforce Investment Board's guidelines state that 51 percent of advisory committee members must be business and industry representatives. To constitute a quorum, the majority of advisers at any meeting must be from business and industry.
- **Enrollment —** The school needs to maintain 50 percent of total capacity, including juniors and seniors.

- **Certification —** All programs must have 100 percent of students taking a Technical Skill Attainment (TSA) evaluation by spring 2012 to fulfill Perkins federal legislation requirements. The U.S. Department of Education has set a pass rate of 62.5 percent for secondary CT students. The WorkKeys skills assessment system will be used to measure student success in all programs that lack a TSA.
- **Occupational Outlook —** The U.S. Department of Labor's *Occupational Outlook Handbook* and the Missouri Economic Research and Information Center (MERIC) are principle sources of information on occupational projections. MERIC was selected as the primary source because its projections are provided in grade format (i.e., "A" equals Excellent and "F" equals Poor on a five-level scale).

"The purpose of the PSI score card is to evaluate programs, not teachers," said **John Gaal**, director of training and workforce development for the Carpenters' District Council of Greater St. Louis. "It is not about crossing off programs but about having a systematic way to evaluate the effectiveness of programs."

Program terminations will involve a three-tier process. Programs that do not meet the PSI and baseline criteria will be placed on a "Watch" list. If a program continues to fall below the criteria in the second year, it will be placed on "Probation." Programs that continue to perform below acceptable levels for a third year may be recommended by the advisory committee to the school board for "Termination."

During the first year of implementation, 24 percent of CT programs in the St. Louis district were placed on the "Watch" list. "The committee didn't think this was an unusual number for the first year," Gaal said.

The committee is considering adding one more area — CT Student Organizations — to the score card. "One of the districts we studied had included student organizations in its model for evaluating programs," Gaal said.

Contact:
John Gaal
jgaal@carpdc.org

Improving Communication Between Shared-time Technology Centers and Home High Schools to Create Individualized Programs of Academic and Technical Study Aligned With Students' Talents, Interests and Goals

Technology Center Partners With High Schools and Middle Grades Schools to Ensure Students' Success

Dothan Technology Center (DTC) in Dothan, Alabama, enrolls some 650 career-oriented students in grades nine through 12. Because of limited openings and high student interest in some classes, a selection process is in place.

An interested student should have a documented career interest inventory indicating that his or her class choices reflect a career goal; be committed to at least one full year of classes in a particular pathway; have full support of his or her parents or guardian(s), including a meeting with the DTC counselor or program instructor prior to enrollment; and agree to join the student organization for a chosen program area. Some DTC courses accept ninth-graders, but most programs begin in grades 10 or 11.

The career programs available at DTC are automotive technology, computer electronics, travel and tourism, electrical technology, health science, carpentry and cabinet-making, cosmetology and nail technology, culinary arts, drafting, graphic arts, masonry and pre-engineering. The pre-engineering academy is based on Project Lead The Way (PLTW).

Middle Grades Program

DTC's pre-engineering program coordinates with middle grades students in Gateway to Technology (GTT) — the middle grades pathway to PLTW — in an after-school robotics program. At DTC, these middle grades students work with their GTT instructor, the pre-engineering instructor, high school students, community volunteers

"The Key Practices of *Technology Centers That Work* are translating into higher student achievement and keeping students in school until graduation."

Sylvia Shepherd
Dothan Technology Center

Contact:
Sylvia Shepherd
sshepherd@dothan.k12.al.us

and local business and industry partners to prepare for local competitions as well as contests sponsored by Alabama colleges. Two local middle grades schools participate in this program.

CT counselor **Sylvia Shepherd** provides many services to DTC students, including administering career interest inventories, career aptitude tests, required testing for industry certification and the biennial *HSTW* Assessment. She works with individual students to develop six-year plans and meets with students and parents to plan for postsecondary education and other post-high school goals. She also works with CT instructors to coordinate online remediation opportunities for DTC students.

Shepherd visits feeder middle grades schools to introduce eighth-graders to the courses available at DTC and works with middle grades counselors to make transitions easier for incoming students. She coordinates career fairs and hosts tours at DTC to introduce middle grades students to the center's programs.

Working With High Schools

During the month of August, DTC works with two city high schools in a summer bridge program for entering freshmen. The four-day event focuses on study skills, remedial English/language arts and mathematics, and test-taking strategies. Students tour the campus and learn to use their planners.

"Dothan Technology Center and other career/tech centers are in a unique position when it comes to working with students," Shepherd said. "Our instructors can provide opportunities, such as hands-on learning, that may not be available in regular classrooms.

"As we begin to understand the value of increasing the rigor of our programs, partnering with high schools and requiring student mastery of learning, we are making improvements," Shepherd continued. "The Key Practices of *Technology Centers That Work* are translating into higher student achievement and keeping students in school until graduation. It is an ongoing process, but we are getting better at it and beginning to see some payoffs."

All Together Now: Shared-Time Center Solves Scheduling Issues With Associate Schools

Winston County Technical Center (WCTC) in Double Springs, Alabama, serves more than 400 students from four high schools on a shared-time basis. The center provides eight career/technical (CT) programs that it constantly seeks to improve in preparing students for a challenging global and digital economy.

The new superintendent initiated change in the district by calling on the *TCTW* school improvement initiative to conduct a Technical Assistance Visit (TAV) in May 2009. One challenge in the TAV report was how to deliver quality CT instruction when students arrived and left the center at different times throughout the day. "There was a variation of 25 to 30 minutes, depending on the students' home schools," said **Shandy Porter**, the center's director/principal. "A consultant from *TCTW* helped us tackle the issue."

Counselors from the feeder high schools were included in the TAV process to learn firsthand about the difficulty of providing quality education with a fragmented schedule. "This helped open the lines of communication with the associate schools and generated dialog on how to overcome the scheduling problems," said **Lauren Archer**, guidance counselor at **Meek High School**, an associate school in Arley, Alabama.

The key steps in moving forward to address the schedule included:

- inviting principals and guidance counselors from the associate schools to visit the center to observe the scheduling.
- increasing communication between the high schools and the center.
- establishing respect among everyone.
- sending representatives of the associate schools to the annual *HSTW* Staff Development Conference to gather ideas from other schools.

Beginning with the 2010-2011 school year, the WCTC schedule was adjusted to better match the scheduling at the associate high schools.

Contacts:

Shandy Porter
sporter@winstonk12.org

Lauren Archer
larcher@winstonk12.org

Solving the Bus Schedule Challenge at a Shared-Time Technology Center

On the first day of school, **Fred Root**, new principal of **Columbia-Greene Career Educational Center** in Hudson, New York, was surprised to hear a bus driver on the school intercom calling for students to board the bus. Root learned that buses from nine sending districts arrived and departed at multiple times during the day.

"I saw the detrimental effects of the schedule on student learning and knew we had to do something about it," Root said. (Root is now a consultant for SREB's *TCTW* initiative.)

Columbia-Greene is one of two CT centers in Questar III, one of 37 BOCES in the state. While this collaboration helps relieve some of the financial burdens on the districts, it may result in other challenges, such as bus transportation.

Students were arriving at Columbia-Greene from their home schools on buses that pulled in from 8 a.m. to 8:35 a.m. for the morning session. The buses left between 10:35 a.m. and 10:55 a.m. The afternoon schedule was similarly busy.

"Students have learned to respect the common starting and ending times. Teachers are enthusiastic about having a normal schedule that allows them to teach the entire class time."

Fred Root
SREB

Contacts:

Fred Root
fredroot1@gmail.com

Dave Leavitt
dave.leavitt@sreb.org

Time Lost From Instruction

"Teachers were faced with the problem of how to provide effective bell-to-bell instruction when they didn't have the same students at the beginning and end of class," Root said.

Root realized that the bus schedule was hindering the school's efforts to carry out the Key Practices of the *TCTW* model.

- It was difficult to demonstrate high expectations when the school was losing large blocks of time waiting for students to come and go.
- The schedule devalued the role of career/technical education by making it appear that instruction at the home school was more important than instruction at the center.
- Students needing extra help could not remain on campus outside of class time.
- Teachers found it difficult to keep students engaged in learning when other students were packing to leave.
- It was hard to integrate academic and CT learning without a whole classroom of students.
- Without proper guidance and advisement, unmotivated students signed up for CT courses so that they would spend less time in class and more time on the bus.

The scheduling problem was not new. Former director **Dave Leavitt**, now a school improvement consultant for SREB, knew the system needed to be changed. Leavitt teamed with Root to make a difference. Root asked superintendents and principals to honor students' time in CT studies. The superintendents offered to write letters to sending school principals about the times to release students. Bus drivers no longer would make that decision.

Principals Visit the Center

The second step was to develop better communication with principals of the sending schools. Root invited the principals to visit the center one at a time to view the workings of CT classes. The principals saw what was happening with bus arrivals and departures during the morning and afternoon sessions. They also saw the effect the schedule was having in the classroom as the instructors waited for students to arrive and leave. "The thing that convinced the principals was seeing what their students were missing because they had to leave early to catch a bus," Root said.

Working together, Root and the superintendents devised a new schedule that honored CT class time, made it possible for the center to serve students better and allowed the center to implement the *TCTW* Key Practices more fully. The changes included adding several buses for more effective transportation, condensing lunch time for some students and providing sack lunches for other students to eat on the bus.

Root is pleased with the new schedule. "Students have learned to respect the common starting and ending times," he said. "Teachers are enthusiastic about having a normal schedule that allows them to teach the entire class time."

Although it is too early to assess the impact on student achievement, Root is optimistic that data will support the efficacy of the new schedule.

Technology Centers Demonstrate How to Improve Relationships With Sending Schools

Technology centers often have difficulty communicating with their sending schools. Such is not the case at three shared-time facilities in SREB's *TCTW* network. These centers have cultivated positive relationships with administrators, teachers and counselors at their sending high schools.

Fred P. Hamilton Career Center in Seneca, South Carolina, hosts middle grades and high school teachers during districtwide professional development days. The teachers tour the center and hear instructors and students describe the programs available there. Director **Mike Pearson** talks with the middle grades and high school teachers about the Perkins Act, end-of-course exams and the importance of literacy and numeracy. As a result of this activity, the machine tool instructor at the center is working with mathematics teachers at the sending schools to strengthen the math skills of CT students.

Director **Rich Payne** of **Cape Girardeau Career and Technology Center** in Cape Girardeau, Missouri, invited mathematics and communications arts teachers from the sending schools to crosswalk math and communications arts standards with CT program competencies. This activity allowed teachers from the sending schools to learn how programs at the center are helping students learn academic subjects through applied learning. Students in some of the center programs have received embedded math and/or communication arts credit in their CT courses.

The center hosts a one-week summer internship for 60 academic teachers, each of whom writes two lessons that integrate academic and CT content. Teachers who participate in the summer event can receive three hours of graduate credit from Southeast Missouri State University.

National Park Technology Center in Hot Springs, Arkansas, encourages teachers to get to know and work with administrators, teachers and counselors at the sending schools. Academic and CT teachers from both facilities have time to collaborate, learn to speak from the same page and develop integrated lessons. Director **David Hughes** and his staff visit the sending schools on a regular basis to get to know administrators and faculty. The center also works with each school district to bring high school and middle grades instructors to tour the programs to see what their students do.

Just as all three centers are part of the *TCTW* network, all of the sending schools are members of the *HSTW* network. As a result, the centers and the sending schools are able to participate in professional development activities on the same topics.

Both Hamilton Career Center and National Park Technology Center received *TCTW* Gold Readiness Awards for having at least 85 percent of students meet at least one readiness goal on the 2010 *HSTW* Assessment; at least 85 percent of students complete one or more parts of the *HSTW*-recommended curriculum; and at least 45 percent of students indicate they experienced an intensive emphasis on high-quality CT studies.

The three directors offered additional suggestions for building relationships with sending schools:

- Ensure that guidance counselors from the sending schools are "on board." Each center holds a Counselor Appreciation Day.
- Send newsletters and other communications to board of education members for the sending schools and to the parents of students attending the centers.
- Develop programs of study jointly with the sending schools to show the connections between classes at the center and at the sending school.
- Ensure that CT teachers include literacy and numeracy in their lessons each week. Work with the sending schools to include CT activities in academic courses.

Contacts:

Mike Pearson
mjpearson@oconee.k12.sc.us

Rich Payne
payner@cape.k12.mo.us

David Hughes
dhughes@npcc.edu

This newsletter of "best practices" in implementing the *High Schools That Work* (*HSTW*), *Making Middle Grades Work* (*MMGW*) and *Technology Centers That Work* (*TCTW*) school improvement models is based on presentations at the 24th Annual *HSTW* Staff Development Conference in Louisville, Kentucky, in July 2010.

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