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the Technology TEACHER

The Voice of Technology Education

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Assistive Technology in the Classroom

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Contents

SEPTEMBER • VOL. 66 • NO 1

Features

Departments

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the Technology TEACHER

The Voice of Technology Education

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As the only national and international association dedicated solely to the development and improvement of technology education, ITEA seeks to provide an open forum for the free exchange of relevant ideas relating to technology education.

Materials appearing in the journal, including advertising, are expressions of the authors and do not necessarily reflect the official policy or the opinion of the association, its officers, or the ITEA Headquarters staff.

Referee Policy

All professional articles in *The Technology Teacher* are refereed, with the exception of selected association activities and reports, and invited articles. Refereed articles are reviewed and approved by the Editorial Board before publication in *The Technology Teacher.* Articles with bylines will be identified as either refereed or invited unless written by ITEA officers on association activities or policies.

To Submit Articles

All articles should be sent directly to the Editor-in-Chief, International Technology Education Association, 1914 Association Drive, Suite 201, Reston, VA 20191-1539.

Please submit articles and photographs via email to kdelapaz@iteaconnect.org. Maximum length for manuscripts is eight pages. Manuscripts should be prepared following the style specified in the Publications Manual of the American Psychological Association, Fifth Edition.

Editorial guidelines and review policies are available by writing directly to ITEA or by visiting www.iteaconnect.org/F7.htm.

Election Candidates

The 2006-2007 ITEA Board of Directors election ballot will be emailed to Professional and active Life Members in September. The highly experienced field of candidates is pictured here. Exercise your right to vote by completing your ballot promptly! Ballots must be submitted to ITEA on or before October 30, 2006.

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ITEA's 69th Annual Conference

Mark your calendar now for March 15-17, 2007 and join ITEA in historic San Antonio, Texas for ITEA's 69th Annual Conference and Exhibition, "Technological Literacy: A Global Challenge." With topics such as "Positioning Technology Education to Lead Educational Reform," "Transforming Technological Literacy Delivery Systems (Pre-K through Adult)," "Showcasing Standards-Based Programs," and "Utilizing Global Learning Communities," the San Antonio conference is one you won't want to miss.

Now the eighth largest city in the U.S., San Antonio has always been a crossroads and meeting place. An historic city on the famed Riverwalk, the warmth you feel is not just from the sunny climate, but from the hearts of its residents. Proud of their city and heritage, they are always ready with the special brand of hospitality for which Texas is so famous. Come feel the excitement and join the fun! Visit www.iteaconnect.org/ for the latest information.

Calendar

October 19-21, 2006 The National Conference on Aviation and Space Education (NCASE) will host "Exploring New Worlds Together" at the Crystal Gateway Marriott in Arlington, VA. Online registration and full event information is available at www.ncase.info.

November 2-4, 2006 The Mississippi Valley Conference and the Southeastern Technology Education Conference (STEC) will hold the first ever combined conference in Nashville, TN at the Radisson Hotel Opryland. The Mississippi Valley Conference will be held all day on Thursday and till lunch on Friday. After Friday's lunch, STEC will hold its conference and will conclude Saturday at noon. All Mississippi Valley and STEC members are welcome to attend both conferences. For more information, contact Hal Harrison, STEC Secretary-Treasurer at 864-656-6967 or hlh@clemson.edu.

November 15-17, 2006 DeVilbiss, Binks, and Owens Community College will present a Spray Finishing Technology Workshop in Toledo, OH. Two Continuing Education Units will be awarded for this intensive three-day training program. Attendees should be involved with industrial, contractor, or maintenance spray finishing applications, or spray equipment sales and distribution. To register, or for additional information, contact Jaime Hollabaugh, Owens Community College, Workforce and Community Services Division, at 800-466-9367 or sprayworkshop@netscape.net. Information is also available online at www.owens.edu/workforce_cs/seminars.html.

November 17, 2006 The Massachusetts Technology Education/Engineering Collaborative will present its 2006 MassTEC Conference at Fitchburg State College. Please consider offering a workshop, sharing an activity, curriculum, or project with your fellow technology education teachers. Workshop presenters attend the conference at no cost and receive three PDPs towards recertification. Workshops are 50 minutes in length, and the college offers AV equipment and support. Submission deadline for presenters is November 1, 2006. Contact Dave Jurewicz at djurewicz@yahoo.com for additional information.

March 15-17, 2007 The 69th Annual ITEA Conference and Exhibition, "Technological Literacy: A Global Challenge," will be held at the Henry B. Gonzalez Convention Center in San Antonio, Texas. Now the eighth largest city in the U.S., San Antonio has always been a crossroads and a meeting place. An historic city on the famed Riverwalk, the warmth you feel is not just from the sunny climate, but from the hearts of its residents. Proud of their city and heritage, they are always ready with the special brand of hospitality for which Texas is so famous. Come feel the excitement and join the fun! Go to www.iteaconnect.org/ for the latest information.

June 21-27, 2007 The PATT-18: Pupils' Attitudes Towards Technology, International Design, and Technology Education Conference, "Teaching and Learning Technological Literacy in the Classroom," will be held in Glasgow, Scotland. For further information about the conference or presentation opportunities, contact the Conference Director, John Dakers at jdakers@educ.gla.ac.uk. Completed papers (2,500–3,000 words) must be emailed to the above address no later than the November 30, 2006.

List your State/Province Association Conference in *TTT*, *TrendScout*, and on ITEA's Web Calendar. Submit conference title, date(s), location, and contact information (at least two months prior to journal publication date) to kcluff@iteaconnect.org.

Passing

Former ITEA member Arthur "Art" Rosser, Ph.D. passed away April 2, 2006. Rosser is the former dean of Central Missouri State University's College of Applied Sciences and Technology. He served as dean for 15 years before retiring in 2002. Rosser was named a Distinguished Technology Educator by ITEA.

Dr. Rosser received three degrees from Ohio Institutions: bachelor's degree from Wilmington College, master's degree from Kent State University, and doctorate from The Ohio State University.

Dr. Rosser was on the faculty at Trenton State College in New Jersey and served as a Dean at both Southeast Missouri State University in Cape Girardeau and Central Missouri State University in Warrensburg, prior to accepting the position as Dean of the School of Technology at Clayton State University in Atlanta, Georgia.

Financial Assistance for San Antonio

NOW...is the time to start finding financial assistance to go to ITEA's San Antonio Conference, March 15-17, 2007. There are numerous places to find financial support, and it takes a certain mindset to be successful. Here are some hints to help you!

- Compile facts on the ITEA conference, such as:

  1) It is the largest technology education professional development experience in the U.S., and you need that experience.
  2) The largest trade exhibition in the country will be available, showing the latest in resources, materials, and equipment.
  3) The nation's educational leaders meet here to network, determine directions, and share decisions on issues that influence the profession.

- Create talking points (after reviewing the program) as to how this conference program could improve education for your students. Don't forget to share that you will learn more about teaching math, reading, and science concepts!
- Stress to the administration that you will be attending as a representative of the school and district at an international conference and what an honor it will be to go as an ambassador for the school. Administrators love to have their schools touted at functions.
- Print the preliminary program and share it with your potential funder.
- Apply to be part of the program, e.g., the teacher showcase known as the Technology Festival. Here you can share your best ideas, activities, or teaching strategies in a one-to-one discussion with other teachers.
- Have a small budget put together based upon travel, registration costs, housing, etc., so when asked how much

you need, the answer is readily available. A single source may not have all the money you need, but coupled with another, you might get totally funded!

- Apply to be a Teacher or Program Excellence winner, bringing positive recognition to your school and program.
- Most technology teachers have found success when applying for professional development monies early in the school year.

Don't wait until the last minute and expect success. When school starts, your funding efforts should start!

Where to look for funding sources...

- Talk to your immediate supervisor about using professional development monies. That person may also be the principal, district curriculum specialist, county supervisor, or a combination of any of these individuals.
- Ask your local PTA for assistance using the information above.
- Search for project monies that relate to your school system's special projects. Sometimes a project on special education, special needs, or some other area of emphasis includes professional development funding. ITEA conferences have an array of programs that touch on many different areas of education. Make the relationship and seek their funding.
- Become friends with local civic groups that support education. For example, the Lions or Rotary Clubs often will support teachers desiring to get professional development. Assure the group that you would be pleased to give a small report on what you have learned. They will be thrilled to know that they have helped your program, and you will have an opportunity to sell your good work to the community.
- Contact your district or state supervisor who deals with technology education. Frequently, they know of funding, such as the Perkins Legislation or the Math/Science Initiatives, that can be used to help you. You will have to complete paperwork, so start the process now!
- Currently, the Wells Fargo Bank (if in your community) is willing to provide limited awards for professional development.
- Do a search of local educational foundations. For example, selected companies have national educational funding programs that they wish to utilize in state or regional company locations. A local representative of a large organization may be able to find funding that will help you.
- Check with your local teacher's union. You pay dues, and they may have a program that will help you.

Assume that you are going to get funded with every potential source that you ask. You will be surprised to find that the one place where you thought there was no funding will be your new source. Remember, most of your colleagues are not aware of the potential for funding. That makes your opportunity for success even greater.

Editorial

By Katie de la Paz

Many thanks to all those who responded to our 2006 Readership Survey. We appreciate the time you've taken to provide us with valuable feedback.

What did we learn? Some things we already knew, e.g., a preference for more "classroom teacher written" articles. We've expended a great deal of effort towards this goal but still seem to be missing the "magic bullet" that will persuade more teachers to write about their experiences. And while 60 percent of respondents said they have considered writing an article, when asked why they don't submit articles, many responses were echoed over and over, "I don't have time; I don't have enough experience; I don't write well enough." The irony is, with such a commonality in responses, clearly many members are in the same boat and would appreciate articles written by "ordinary" teachers even more. In fact, in response to survey question number three, "What aspect of *TTT* do you enjoy the most or find most helpful," many reported appreciating "seeing what other tech ed teachers are doing."

In question seven we asked "What other topics would you like to see covered in the publications?" Based on the most common responses to this question, we're in the process of formulating a new series of "invited" articles, trying out various formats, in an attempt to fulfill this reader request. Please see the NCLB alignment article on page 17 of this issue to take a look at the first installment of this new series. Our goal is to cover one "hot" topic in each issue.

You probably have already noticed that the "look" of the journal has changed. Again, in response to your requests, we've attempted to give the journal a less cluttered, "cleaner" look that is easier to read and navigate.

With some questions, we have a fairly good idea what the responses will be. With others, however, we are charting new territory. We didn't know what to expect in response to our question about when readers see themselves preferring an electronic version of *TTT*. While a portion of respondents felt strongly about wanting an electronic version, "Doing it online is the way to go," an overwhelming majority said either, "not now" or "never." Thanks for the heads-up—we'll keep printing AND posting online for now.

Keep in mind that your feedback is welcome at any time, not just by way of our annual survey. I invite your opinions via email at kdelapaz@iteaconnect.org. I look forward to sharing an exciting and informative school year with all of you through your journal.

Thank you!

Katie de la Paz *is the Editor-in-Chief for the International Technology Education Association. She can be reached via email at kdelapaz@iteaconnect.org.*

Engineering Design in a Mighty Pinwheel Machine Activity

By Kyungsuk Park and Angela McFarland

...the students experienced each step of the engineering-design process.

Introduction

Technology education in elementary school is taught through hands-on activities that are designed to address technology content such as communication, construction, manufacturing, transportation, and biotechnology. According to Park (2004), "hands-on activities are essential in elementary school classrooms since elementary school students learn more through doing something by hand than by listening to knowledge. Knowledge is not transferred from a teacher to a student, but constructed through interaction between individuals or between people and materials" (p. 2). Lunenburg (1998) stated that "children actively construct their knowledge, rather than simply absorbing ideas spoken to them by teachers" (p. 76). Learning technology education produces positive outcomes by opening new avenues of effective learning through hands-on activities (International Technology Education Association, 2000/2002; LaPorte & Sanders, 1996; National Research Council, 1996; Park, 2004; Zuga, 2000).

The pinwheel lesson was created from a unit on the advantages and disadvantages of wind energy. The unit included a historical review of how people have used wind energy and an analysis of the work performed by modern-day wind machines. However, the students needed the chance to take the science knowledge gained from the unit and use it to experience the excitement of making a machine that could actually solve a specific problem. The mighty pinwheel machine activity introduced students to the technology content standards in the engineering-design section.

Design Brief:

Students will design and build a mighty pinwheel machine out of the recycled materials. The number of paper clips lifted as the pinwheel spins will judge the success of the mighty pinwheel machine. The materials needed are cardboard, pinwheel patterns, bendable straws, scissors, toothpicks, Scotch tape, hole punch, and recycled boxes. The procedure is as follows:

1) Color pinwheel with markers.
2) Cut out pattern on lines.
3) Cut slots to create wings for the pinwheel.
4) Bend and glue the wings.
5) Attach the pinwheel to a dowel or strip of wood with a pin.
6) Blow on pinwheel to make sure it spins.
7) Use the recycled materials to make a mighty pinwheel machine that has a base, tower, and a place to attach the pinwheel.
8) Have the students explain what decisions they made when making the base, including details on how they designed the machine to be able to achieve its purpose.
9) Have the students make a prediction of how many paper clips their machines will lift.
10) Test the mighty pinwheel machine to determine how many paper clips it is able to lift to a predetermined height.

Design, Build, and Test

Twenty-six fifth grade students were purposively selected as participants. The students were asked to design and sketch a mighty pinwheel machine. The students were encouraged to keep an engineer journal that was used to record the initial brainstorming ideas generated on how to solve the problem, notes on why they selected certain materials for making the machines, notes on any problems that occurred during

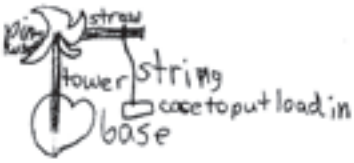
Group	Design Ideas from	Design/Sketch	Final product/Test
1	Windmill		
2	My brain		
3	Success of other groups		
4	Me and my partner		

Table 1. The process of engineering design.

the building process, a drawing of the final product, lessons learned from watching the testing of other machines, and reflections on lessons learned from the entire mighty pinwheel experience. Table 1 shows a sampling of design idea, sketch, and final products.

As shown in Table 1, the students experienced each step of the engineering-design process. They generated the ideas, sketched, constructed, tested the first design, redesigned, and tested the final mighty pinwheel machine.

Connecting to the Standards

A mighty pinwheel machine activity relates to the *STL* standard pertaining to "engineering design" [Standard 9: Students will develop an understanding of engineering design]. According to the International Technology Education Association's *Standards for Technological Literacy: Content for the Study of Technology (STL)* (2000/2002), in order to comprehend engineering design, students in Grades 3-5 should learn that:

(1) The engineering-design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.
(2) When designing an object, it is important to be creative and consider all ideas.
(3) Models are used to communicate and test design ideas and processes (p. 102).

The students had a problem—how to lift a paper clip. They elicited the design ideas from a variety of resources, made a pinwheel machine with the recycled materials, and tested the final project they made.

Conclusion

The purpose of the pinwheel machine is to give students the opportunity to take their scientific knowledge and use it to solve a problem that mimics problems encountered by real engineers. Design challenges of this sort are essential for preparing students to tackle real-life problems. Students need to experience the thrills and frustrations that occur when trying to succeed at something that seems impossible.

A major outcome of technology education in elementary schools is active learning. Students must keep actively involved in hands-on activities, but more importantly they must be engaged socially and cognitively. This requires giving input, responding to peers, and sharing new thoughts and ideas. A mighty pinwheel machine activity is an excellent way to teach the technology content standards, "engineering design" through problem solving, design process, and cooperative learning. It leads students to a transfer activity in which they apply what they learned to real-world problems by building their own pinwheel machine that can accomplish designated tasks. The students have the opportunity to see how the concepts and ideas they learned connect to real-world problems and solutions. With plenty of curiosity, the students began to learn how to design, build, and test a pinwheel machine that was needed to face challenges, similar to the actual efforts facing scientists and engineers in our cities today.

STL (2000/2002) notes the engineering-design process requires creative and critical thinking, the application of technical knowledge, and appreciation of the effects of a design on society and the environment. Through the mighty pinwheel machine activity, the students learned the engineering-design process, helping them foster creative problem-solving skills. In addition, they were introduced to hands-on technology education activity and encouraged to become involved in social interaction with peers. Namely, Elementary School Technology Education (ESTE) creates an exceptional learning environment that brings with it the excitement of building a pinwheel machine that is applicable to real-world situations. It is hoped that ESTE inspires a high level of curiosity, stimulates students' problem-solving abilities, and gives them a chance to better understand how careers in science, technology, and engineering relate to their daily lives.

References

International Technology Education Association. (2000/2002). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

LaPorte, J. E., & Sanders, M. (1996). *Technology Science Mathematics (TSM): Connection activity binder*. New York: Glencoe/McGraw-Hill.

Lunenburg, F. C. (1998). Constructivism and technology: Instructional designs for successful education reform. *Journal of Instructional Psychology*, *25*(2), 75-81.

National Research Council. (1996). *National science education standards.* Washington, DC: National Academy Press.

Park, K. (2004). *The value of technology education to elementary school students' learning of technology concepts and processes: A qualitative investigation of a constructivist perspective*. Unpublished doctoral dissertation, The Ohio State University.

Zuga, K. F. (2000). Technology education as an integrator of science and mathematics. In G. E. Martin (Ed.), *Education for the 21st century, a collection of essays* (pp. 223-227). Peoria, IL: Glencoe/McGraw-Hill.

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This is a refereed article.

Assistive Technology in the Classroom

By David L. Netherton and Walter F. Deal

There is a continued need to provide information about the availability of assistive technology, advances in improving accessibility and functionality of assistive technology, and appropriate methods to secure and utilize assistive technology in order to maximize the independence and participation of individuals with disabilities in society.

Figure 1. Most all computers require the use of a pointing device such as a mouse to interact with screen prompts, select and enter data, or execute software processes and operations. The hat shown in the photograph actually has a special Infrared reflective material on the brim that works in conjunction with a small transmitting device and software that provides very accurate screen pointer control. The user just moves his or her head to control the pointer on the computer screen. This enables a person with poor or no motor control of their hands to interact with a computer.

Perspective

A new teacher or one who has been on the front lines for a number of years soon recognizes that not all children learn the same way or have the same needs for successful learning experiences. Through undergraduate teacher training or in-service workshops, teachers gain useful skills in using technology to plan, prepare, and provide instruction. Technology and career and technical education teachers frequently have the skills, knowledge, and tools to provide successful learning experiences for children with wide ranges of abilities beyond what may be expected of traditional teachers. However, as we look at federal and state laws and regulations regarding children identified with special needs, we will find that there are a number of resources that are available to assist in acquiring or purchasing special technology for class members who have unique needs.

It is easy to recognize that computer and information technologies play a major role in business, industry, and education. Additionally, communication and information technology has become a required tool for academic achievements and participation in activities. All students, including students with disabilities, need to be able to access this technology. As career and technical education teachers, we can use information technologies to create and enhance the learning experiences.

What is Assistive Technology?

Assistive technology is any piece of equipment or device that may be used by a person with a disability to perform specific tasks, improve functional capabilities, and become more independent. It can help redefine what is possible for people with a wide range of cognitive, physical, or sensory disabilities. (RESNA)

Very simply, assistive technology may enable a person with a disability to do something they normally would not be able to do on their own, such as fishing or boating, talking on the phone, opening a drawer, cooking dinner, buttoning a shirt, or reading his or her bank statement. Assistive technology may include cognitive aids, adaptive toys, communication aids, alternative computer access, aids to assist with walking, dressing, and other activities, visual aids, or aids to augment hearing that facilitate activities typically done as part of daily living.

This technology may range from very low-cost, low-tech adaptations (such as a "battery interrupter" to make a toy switch accessible) to high-tech, very expensive devices (such as a powered wheelchair and environmental controller operated by tongue-touch). An example alternative means of operating a personal computer and interacting with software is the "Natural Point" hands-free alternative mouse-pointing system.

People with disabilities may use assistive technology to participate in everyday activities encountered in learning, recreation, and work. Assistive technology can help individuals become mobile, communicate more effectively by seeing and hearing better, and participate more fully in learning activities. Screen and reading magnifying technologies can be used to magnify computer applications and software as well as print physical objects such as shown in Figures 2 and 3. Computer-screen magnifiers allow the user to "split" a screen into two views—one normal view along with a magnified view. The degree of magnification can be controlled by the user to suit his or her needs. Further, screen magnifiers also may have a full-screen magnification

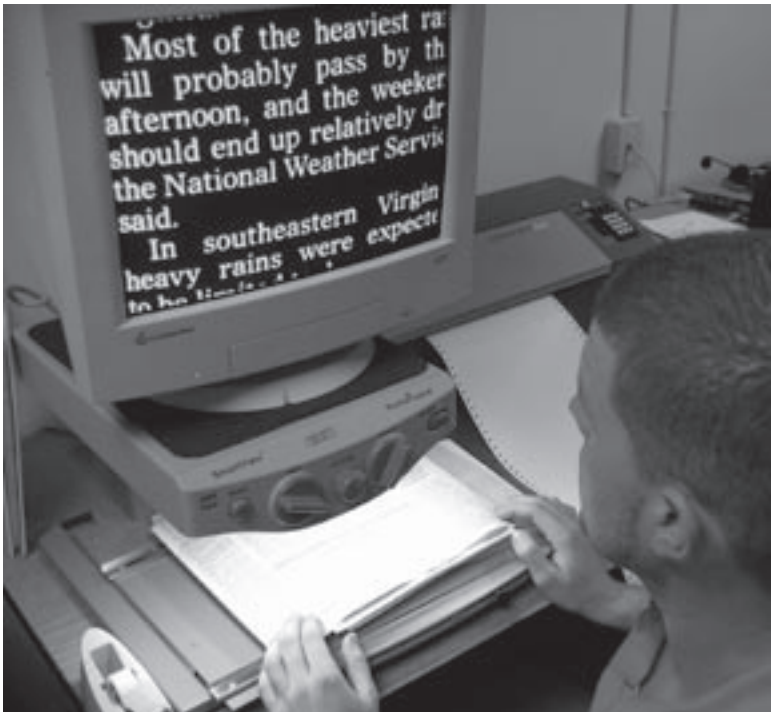

Figure 2. A low-vision device such as this HumanWare's Smart View© shown in an assistive technology demonstration lab at Old Dominion University, is an example of a video magnifier and can be used to magnify static and moving objects. The video technology consists of a video camera and display device that can be used to provide magnified vision of printed materials and provide the capability to "work under the camera" to do manipulative activities such as writing or working with small parts and components.

Figure 3. Frequently, visually impaired individuals can benefit significantly with simple visual enhancement tools such as computer-screen magnifiers. Screen magnification can be controlled by the user and configured to magnify areas of a screen or the complete screen with magnifications to about 10X.

mode as opposed to a split screen. Low-vision devices such as HumanWare's Smart View© is an example of a video magnifier and can be used to magnify static and moving objects, e.g., reading text material or writing assignments that may parallel learning activities.

As career and technical education teachers, we may employ examples of accessible electronic and information technology in education in the following ways:

- Accessible webpages allow students with disabilities to access information, share their work, communicate with peers, teachers, and mentors, and take advantage of online learning options.
- Accessible instructional software (on disks, CDs, or other media) and documentation allow students with disabilities to participate side by side with their peers in computer labs and classrooms; collaborate with each other; create and view presentations, documents, and spreadsheets; and actively participate in simulations and all other academic activities.
- Accessible telecommunications and office equipment make communication and educational administrative functions accessible to everyone, including people with mobility, visual, and hearing impairments. (VATS)

Case Studies Provide Insights

Perhaps one of the easiest ways to describe and illustrate how assistive technologies can be used is through the use of case studies. Betsy and Henry are two individuals who can benefit though the use of assistive technologies. While their stories are brief, they do provide insights as to how technology can expand their horizons and independence.

Betsy's Story

Betsy, an eighteen-year-old with mild cognitive delays and CP, is in high school. She has been using a laptop computer and switch-access hardware and software in lieu of a pencil and paper to complete work in high school. The equipment and software were provided by the school district through the IEP process. Betsy's current goal, articulated in her Individual Transition Plan (ITP) as mandated by IDEA, is to have a full-time job by the time she is 22. She wants to work in an office and would use a computer system similar to her current setup. As she moves into the transition period, these questions must be addressed:

- Will the laptop computer she has been using be functional for her in the workplace?
- Will she need to consider new equipment? What would influence a decision to purchase new equipment?
- What funding sources might help Betsy to purchase new equipment?
- What case should Betsy make for funding?

Betsy is fortunate to have learned computer and word-processing skills in her career and technical education classes. Now she must learn ways to transfer these skills into the work setting. Laptop computers are not typical in offices; instead what Betsy is more likely to encounter is a desktop workstation with computer and printer. In order to use a standard computer, Betsy will need a switch-access device and an onscreen keyboard to do word processing and data entry.

Since single switch access is necessary for Betsy to become employed in an office setting, Betsy's vocational rehabilitation counselor was willing to make such a purchase for her. Betsy applied to be a data processor with a temporary employment firm and got the job. Betsy's vocational rehabilitation counselor helped her to select switch-access hardware compatible with most Windows-compatible computers. In her new job, Betsy changes office settings frequently. Each time she moves, she takes her switch-access device and onscreen keyboard software with her. With these portable items, she is able to adapt each new office setting to meet her needs. Having the right technology has made Betsy an adaptable and successful temporary office employee.

Assistive Technology at School Age and Beyond

When students enter kindergarten and begin their regular public school years, assistive technology can be a part of their special education programs. For students who are eligible for special education, assistive technology must be provided when it is necessary to do one of the following:

- Support placement in the least restrictive environment.
- Ensure that a student benefits from his or her education.
- Implement the goals and objectives in the student's IEP.

Assistive technology should be considered as an option for every IEP. Some students, of course, will not require technology, but many students will benefit from technology that helps them to compensate for their impairments. School districts are not required to provide all of the possible assistive devices that might be nice to have or might provide the best possible arrangements. Assistive technology is required, however, when its presence enables the student to make reasonable progress toward the goals the IEP Team identifies.

Assistive technology can be included in the IEP in a number

of ways. It may appear as part of the student's annual goals or short-term objectives. It may also appear in a list of specific accommodations that need to be made in order for the student to function in the least restrictive environment. For example, the IEP might include such accommodations as the use of word processing, use of a calculator, use of a hand-held spell checker, or text-to-speech technology as shown in Figure 4. In addition, the IEP may specify that, as a related service necessary for the student to benefit from his or her education, the student will receive training in the use of assistive equipment like an electronic communication device, a power wheelchair, or a personal computer.

Figure 4. Special predictive text-to-speech word prediction software may be installed on Windows-based computers that can provide rapid text-to-speech output that is compatible with a variety of speech synthesizers and word-processing software. Augmentative communication products such as Word + EZ Keys can provide the capability for users to communicate easily and effectively. Additionally, the software will accommodate a variety of inputs such as keyboard, mouse, switch, joystick, or track balls.

Henry's Story

Henry is a seventh grader with a neuro-muscular disease that has caused him to lose physical function. He is a bright student with excellent academic skills. Henry uses a laptop computer with a trackball and an onscreen keyboard to do all his written work. He navigates skillfully around the school building using a power wheelchair. Technology has really helped Henry to fit in and do well at school. However, now as a young adolescent, Henry is beginning to feel left out socially. He requires so much help with his physical needs that he has to spend lots of time with adults. Henry wants to "hang out" like the other kids his age and escape adult scrutiny once in a while.

Henry is nonverbal. He uses a complex, sophisticated electronic communication device to participate in class. The device is programmed with phrases that Henry frequently uses, and he also can select icons to create sentences of his own. Henry's communication device works well for him in formal classroom settings, but it is bulky and cumbersome to use in casual conversation with friends. Henry has come to believe that his communication device is actually a barrier to the kinds of informal interactions he wants to have.

Henry knows that he has the best in technology and that the equipment he uses was very expensive. He doesn't want to appear "greedy" or demanding, so he has not told his parents about his dissatisfaction with his ability to communicate. One of Henry's friends, John, however, noticed that Henry was acting pensive and unusually quiet. John gently coaxed the truth out of Henry and offered to help his friend think of a new way to "talk" that would provide him with more flexibility and independence.

When Henry and John put their heads together, they came up with lots of ideas. The one they settled on as the most feasible involved using the laptop that Henry already had. The laptop had some advantages because it was small and portable and Henry already knew how to use it very well. In a catalog of special-needs software, the friends found communication software that operated on an icon system, and the price was right—around $100. With communication software installed on the laptop, Henry had a simpler, more portable device for talking in casual settings.

Next, John asked his technology education teacher to help them design a tray for Henry's wheelchair that would hold the laptop and fold down beside the chair out of the way when not in use. The technology teacher fielded the idea and design problem with his Design and Technology class for solutions. One design team came up with a clever tray on hinges that folded to the side. The laptop fastened to the tray with wide rubber bands. A handle on the tray allowed Henry to raise and lower the tray as needed.

In addition to his laptop, Henry also needed a device for quick greetings and spontaneous retorts. Henry and John chose a programmable switch with the capacity to record up to 12 messages. Henry could operate the switch quickly by hitting it with his elbow. He and John had a great time recording messages suitable for talking to their friends or to girls.

What Henry found out was that he needed multiple ways to communicate so that he could customize his electronic speech to fit the setting and the occasion. For a relatively small financial investment, Henry and John were able to expand communication possibilities for Henry and allow him greater control and personal choice about what he said, how he said it, and to whom.

Summary

Substantial progress has been made in the development of assistive technology devices, including adaptations to existing devices that facilitate activities of daily living that significantly benefit individuals with disabilities of all ages. These devices, including adaptations, increase involvement in, and reduce expenditures associated with, programs and activities that facilitate communication, ensure independent functioning, enable early childhood development, support educational achievement, provide and enhance employment options, and enable full participation in community living for individuals with disabilities. Access to such devices can also reduce expenditures associated with early childhood intervention, education, rehabilitation and training, health care, employment, residential living, independent living, recreation opportunities, and other aspects of daily living.

Technology and career and technical education teachers frequently have the skills, knowledge, and tools to provide successful learning experiences for children with wide ranges of abilities beyond what may be expected of traditional teachers. Recognizing these needs and using assistive technologies can open up new horizons opportunities for students in career and technical education classes.

Over the last 15 years, the federal government has invested in the development of comprehensive statewide programs of technology-related assistance that have proven effective in assisting individuals with disabilities in accessing assistive technology devices and assistive technology services. This partnership between the federal government and states provided an important service to individuals with disabilities by strengthening the capacity of each state to assist individuals with disabilities of all ages meet their assistive technology needs.

Despite the success of the federal/state partnership in providing access to assistive technology devices and assistive technology services, there is a continued need to provide information about the availability of assistive technology, advances in improving accessibility and functionality of assistive technology, and appropriate methods to secure and utilize assistive technology in order to maximize the independence and participation of individuals with disabilities in society.

The combination of significant recent changes in federal policy (including changes to section 508 of the Rehabilitation Act of 1973 [29 U.S.C. 794d], accessibility provisions of the Help America Vote Act of 2002 [42 U.S.C. 15301 et seq.], and the amendments made to the Elementary and Secondary Education Act of 1965 [20 U.S.C. 6301 et seq.] by the No Child Left Behind Act of 2001) and the rapid and unending evolution of technology require a federal/state investment in state assistive technology systems to continue to ensure that individuals with disabilities reap the benefits of the technological revolution and participate fully in life in their communities.

Here are some examples of state assistive technology programs:

Iowa Program for Assistive Technology (IPAT)
Access to information, training, and equipment is critical to making the right choices and actually using assistive technology. Between 2003 and 2004, IPAT provided 1,464 device loans, responded to over 1,000 information requests per month, and held over 190 training events to provide skill-development training to over 3,200 consumers and service providers. IPAT has a 14-year relationship with the Iowa Department of Education and the Area Education Agencies (AEA) AT Team. Last year, through a collaborative effort, regular education classroom teachers from each AEA were provided training and technical assistance in how to use text-reader software with study skills for not only students with IEPs, but for all students in their classrooms.

Pennsylvania's Initiative on Assistive Technology (PIAT)
In program year 2003-04, Pennsylvania's Initiative on Assistive Technology provided more than 10,000 consumers and family members, service providers, faculty, and others with presentations, device demonstrations, training events, and awareness-level activities related to the scope and potential of assistive technology for persons with disabilities and older Pennsylvanians. In SFY 2004, there were more than 5500 devices shipped from Pennsylvania's Assistive Technology Lending Library (a program run by PIAT with state support in addition to some federal support) in response to almost 4000 individual requests for devices to "try before you buy" (including to more than 1100 first-time borrowers). In addition, almost $200,000 worth of "previously owned" equipment was either sold or donated to individuals with disabilities.

Oklahoma ABLE Tech
Oklahoma has the highest Native American population in the nation, with more than 252,000 tribal members. The rate of disability among Native Americans is approximately 22.6%. In 2003, OK ABLE Tech provided equipment demonstrations to 125 individuals, equipment loans to 185 individuals, and direct information and referral to 3,364 individuals.

Missouri Assistive Technology (MoAT)
Between 2003 and 2004 the MO TAP for Internet Program provided 1168 adaptive computer devices representing over 160 different individual items. A majority of applicants (73%) received assistance with selecting their equipment, and (46%) received training on their equipment. Missouri is the only state in the nation whose telecommunications equipment distribution program, which is administered by MoAT, includes adaptive devices for Internet access. Consumers range in age from 2-90 and include a wide array of disabilities.

North Carolina Assistive Technology Program (NCATP)
In program year 2003-04, the North Carolina Assistive Technology Program provided technical consultations to 7,770 individuals including demonstration of equipment to help individuals select appropriate devices. 2,757 equipment loans for short-term tryout were made that year, and 1,321 people received assistive technology funding resource information and consultation.

North Dakota Interagency Program for Assistive Technology (IPAT)
From June 2003-May 2004, IPAT served 1,344 seniors through the SATS program, eliminating or delaying institutionalization for those state seniors 60 years or older.

"I am in fifth grade at Baldwin School. I have a learning disability in written language, which makes reading and spelling very hard. IPAT helped figure out what assistive technology might help me. I got my AlphaSmart and Franklin Language Master in December. I use them every day to do assignments and reports. I am able to complete some of my assignments by myself and don't always need someone to write for me. Thank you IPAT Program"… Elementary school student - Baldwin, ND.

From June 2003-May 2004, the IPAT Technology Access Center (TAC) provided 50 AT assessments, 7 AT trainings, 18 demonstrations, and 16 teleconferences benefiting over 200 North Dakota consumers and service providers.

Virginia Assistive Technology System (VATS)
VATS has received federal funding from the National Institute on Disability and Rehabilitation Research since 1990 to develop a statewide comprehensive system of assistive technology (AT) and to assist Virginians with disabilities in accessing assistive and information technology (IT) devices and services. Some of their successes include:

- Supported passage of "The Virginia Assistive Technology Device Warranties Act." This act guarantees Virginians with disabilities who use devices the same protection that customers have for "lemon" automobiles.
- Established the Virginia Assistive Technology Loan Fund Authority (ATLFA), providing low-interest, guaranteed loans for the purchase of assistive technology. www.atlfa.org
- Formed an inter-state consortium with Tech Act Projects and the ADA Information Center in the Mid-Atlantic Region that received federal grant funds to ensure education-based information technology access.
- Collaborated with the Virginia Information Technology Agency on implementing Section 508 standards to ensure the accessibility of information technology.
- Produced valuable resource publications such as "Assistive Technology in the Student's Individualized Education Program: A Handbook for Parents and School Personnel."
- Provided targeted AT workshops such as "Gadgets and Gizmos" that increased awareness of AT solutions, and enhanced independence and greater safety for aging Virginians.

References

RESNA, Public Law 108-364, Oct. 5, 2005. www.resna.org/taproject/library/laws/pl108-364.pdf, Retrieved June 30, 2006.

Virginia Assistive Technology System (VATS). www.vats.org/content/whatsnews.htm, Retrieved June 30, 2006.

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CITY OF SAN ANTONIO
PHIL HARDBERGER
MAYOR

Welcome
¡Bienvenidos!

As the Mayor of the City of San Antonio, on behalf of my colleagues and the citizens, I am pleased to invite members of the International Technology Education Association to San Antonio for your 69th annual conference. We are delighted to host this important annual event.

San Antonio is the seventh largest city and very proud of the distinction that we have earned as one of the most unique and charming cities in the country. While you are here for business, please take time to enjoy the various sights and sounds that draw over 21 million visitors annually to San Antonio year after year. From the historic Alamo to the famous River Walk, we have a multitude of choices for everyone. I hope you will have a productive conference and a very memorable stay.

Sincerely,

Phil Hardberger

Phil Hardberger
Mayor

Six Concepts To Help You Align With NCLB

By Dale Hanson, Darla Burton, and Greg Guam, DTE

How can technology and engineering education survive and thrive in a time when only core subjects seem to be valued?

If you are reading this, chances are you have survived the first five years of the 2001 reauthorization of the Elementary and Secondary Education Act (ESEA), also known as No Child Left Behind. This legislation has been controversial, evolutionary, and confusing for many. Its provisions have spawned numerous school improvement initiatives and reform. It has also been misunderstood, misapplied, and misinterpreted in ways that were not originally intended. Considering the actual legislation is approximately 1400 pages in length that may be easy to do. The overall goal of the No Child Left Behind (NCLB) Act is to have all students—100 percent—achieving at proficient levels by 2014. Between now and 2014, states, districts, and schools must take a series of specific steps toward that goal. The law requires that we focus intensively on challenging academic standards and assessments in reading, math, and science, accountability for the performance of every child, and the guarantee of a highly qualified teacher in every classroom.

There are several key components of the legislation that greatly affect school districts:

- All students at specific grade levels will be assessed to determine if they are achieving state-determined levels of proficiency in math and reading. Science assessments will begin in the 2007-08 school year. Each state negotiates its proficiency levels with the federal government.
- All school districts will be measured against the concept of adequate yearly progress (AYP), which creates a benchmark for continuous improvement.
- AYP must be met not only as a whole school population, but also must be met in each of nine subgroups: gender, racial/ethnic minority (four groups), disability, limited English proficient, low income/economically disadvantaged, and migrant.
- All schools must employ "highly qualified teachers."

All of this can certainly seem overwhelming at best, and there are many factors that are out of our control. There are, however, several concepts and practices that can assist you in refocusing and solidifying your technology education program to align with NCLB goals. How can technology and engineering education survive and thrive in a time when only core subjects seem to be valued? Now is an excellent time for technology and engineering education teachers to lead and collaborate in showing what is essential for student success. Here are several concepts and strategies to help you succeed.

- **Concept 1:** ***Accountability is here to stay.*** NCLB has evolved considerably since its inception and will continue to evolve to meet its aims. However, the one piece of the Act that has remained constant is that of a level of accountability for student achievement. In the past several years there has been a marked increase in the collection of data used to measure performance. NCLB requires reports on individual schools that are a part of annual district report cards, also known as local report cards. Each school district must prepare and disseminate

annual local report cards that include information on how students in the district and in each school performed on state assessments. The report cards must state student performance in terms of various levels of proficiency in the areas of: basic, proficient, and advanced. Achievement data must be disaggregated, or broken out, by the nine previously mentioned student subgroups. Communication of progress between parents, schools, and government is increasing steadily. Schools are instituting reform models that are tied to the goal of improving achievement as measured by AYP. Accountability is paramount to the future of technology education. If you have not done so already, consider the following:

- Instituting tangible measures of your class outcomes to the school's goals (e.g., design assessment instruments such as structured observations, checklists, rubrics, or portfolios to match the activities the students will use to demonstrate content mastery).
- Pre and posttesting for specific and general employability skills should be considered, along with ongoing assessments that indicate the knowledge gained in the tested areas that connect with the content of respective technology education courses.
- Sustained, value-added technology education programming should be communicated as successes to the school board, businesses, and the community.

Measures of progress must be put into action to demonstrate the value added in students' knowledge and skill development. Is your technology program connected to your school improvement plan? How are you measuring your improvement?

- **Concept 2:** ***Data-based decisions will drive our curriculum.*** As mentioned earlier, schools are dealing with ever-increasing amounts of data that measure everything, including student achievement data, demographic data, financial data, community needs data, and school climate data. Administrators are dealing with increasing pressures to raise achievement and meet local, state, and federal mandates, while, in many cases reducing expenditures at the same time. Understanding this dynamic may necessitate that teachers have discussions with administrators to ease these pressures as well as understand the plans to move forward. This is an excellent time to advocate for your programs as you begin to understand how you are meeting the school's needs for improvement. Think about the following possibilities of using data to your advantage:

  - **Effective data gathering.** Examine how your district staff and teachers used to gather and share data, including student achievement data as well as other organizational data. Then develop best practices for gathering and sharing data.
  - **Outcome assessments.** Districts need to provide context for the data that they gather. This effort helps to identify curricular gaps through assessment results. It also examines how district assessments are aligned with state standards and whether professional development is structured to better address curricular gaps.
  - **Monitoring and feedback.** Progressive districts monitor the effectiveness of specific programs or efforts, and highlight evidence that shows how departments, different sites, and certain programs are performing.
  - **Ownership of outcomes.** Specific individuals throughout the district must be held accountable for the performance of students. Who analyzes current measures and assessments? Who is responsible for the results, and how and what interventions are put in place? Determining ownership also includes designing processes for evaluating the effectiveness of these interventions, incentives to achieve desired results, and evidence of an organizational culture that supports these efforts.
  - **Building a learning organization.** Establish the processes and behaviors that deliver a performance-driven culture. Staff and faculty must match the district's resources to its goals, and then evaluate the fit between them on an ongoing basis.

  We are at a point where school and curricular decisions need to be made on data and not what our gut tells us. Are you using current and relevant data?

- **Concept 3**: ***Reading in the content area.*** One of the biggest challenges schools face is that the spotlight is shining brightly on the many students who are not able to read at grade level. As new evaluation tools are developed, schools are able to home in on each student's specific needs. You may, at this point, say to yourself that it looks like the reading and communication arts instructors have their work cut out for them. You are correct. But this is also a time for technology

and engineering teachers to bring value to the table through reading in the content area. Think about how you can use the following to enhance your standing:

- Lexile your class reading material (see below).
- Assess each student's lexile level at the beginning of the year (do your materials match?).
- Assess each student's lexile level at the end of the year.
- Share this information with your administrator.

Reading teachers teach reading in a general context. Technology and engineering teachers have the ability to focus on students' reading in the technology and engineering education context. You may say that you are not a reading teacher, but I will propose that any teacher who uses written materials teaches reading. The first thing you can do is understand the concept of lexile and use it in your classes. A lexile is a measure of text difficulty based on semantic difficulty (word frequency) and syntactic complexity (sentence length). A lexile scale indicates the range at which a student is most likely to comprehend material with 75% accuracy. The correlations to reading at a grade level are given in ranges. There is not a specific lexile measure to a specific grade level. Additional information is available at www.lexile.com.

Lexile Scale

Grade	Proficient Lexile Scale Range
1	100-400
2	300-600
3	500-800
4	600-900
5	700-1000
6	800-1050
7	850-1100
8	900-1150
9	1000-1200
10	1025-1250
11	1050-1300

You are now able to ensure that your text materials are appropriate to your age group. Lexile.com has a large database that allows materials to be lexiled to a grade range. Reading technology education materials can assist students in improving their overall reading skills if the materials are interesting and engaging as well as properly leveled. High touch has historically been a hallmark of successful technology education programs, but in this new era, interesting, rigorous, and relevant reading in technology and engineering will take on increased importance. An analysis of entry-level jobs has found them to have higher reading requirements than many high school tests required for graduation. States need to be sure that the proficiency levels they set under NCLB reflect not just traditional measures of academic reading competence, but also the larger picture of employability and life after graduation. Reading competency is an example of the academics that we must emphasize in technology and engineering education. What can you do to further your students' reading skills in your classes?

- **Concept 4:** ***Integration and collaboration with core subjects strengthens technology and engineering education and the core subjects.*** Technology and engineering education have always enjoyed their status as coursework that applies the learning in the core academic classes. The contextual learning in our classes has been an important link to students' transition to post-secondary opportunities. The "aha!" that students get when they apply math, science, English, or social studies concepts has been witnessed by most all technology educators. A comparison of content standards in core areas to the technology standards will find some commonality in goals. For example, if you are teaching scaling techniques in architecture, you are teaching ratios in mathematics. Technology education overlaps a great deal in the science and mathematics areas. With the advent of curriculum mapping programs, it is becoming easier to coordinate with other subjects when concepts are taught. An example of a curriculum mapping product can be found at www.eclipseacademic.com. It is also important to advocate for core academic teachers to implement technology-applied learning into their curriculum. As mentioned previously, this is an opportunity to realize the efficiency of curriculum mapping.

  Consider the following strategies for integration and collaboration:

  - Curriculum mapping
  - Continue to build relationships and show connections with core content

Are you looking for connections to other content areas and looking for efficiencies in delivering your content?

- **Concept 5:** ***Contextual learning in technology and engineering education connects students to the real world.*** The world of work is changing and so is the world of technology and engineering education. The world has "flattened," and a significant shift is occurring between careers that are growing and those becoming vulnerable to global competition. Here are some opportunities to expand this area:

  - Focus on multiple pathways for our students to connect with current educational and work opportunities vs. training for entry-level positions.
  - Initiate articulation agreements with technical, two- and four-year colleges to enhance your programs, give students a boost to their postsecondary career, and endear parents.
  - Consider the possibility of leading your school in the creation of a career academy focusing on technology education postsecondary opportunities and careers.

Are you opening the minds of your student population so they can learn concepts and techniques that will open doors of opportunity for them throughout their lives?

- **Concept 6:** ***Communicating technology and engineering education's value in supporting NCLB.*** Now that you understand the Act, are using data to measure and improve achievement, have focused on reading skill and level in technology and engineering education, collaborated and integrated with core subjects, and continue to maintain currency of your program, it is time to share with your administration and community just how well positioned your program is to succeed in supporting No Child Left Behind. Consider doing the following:

  - Continue to build positive relationships with your administration and school board and share your efforts and successes.
  - Present your best practices to community groups, such as the Chamber of Commerce, Kiwanis, advisory groups, etc.
  - Share with parents by holding or participating in your school's open house to showcase student work and achievements.
  - Celebrate excellence and continue to show students the value and application of success in other content areas.

There are many who say that "if your course isn't tested under NCLB, it will become extinct." We firmly believe the opposite to be true. Now is the time for technology and engineering educators to step up and become "the complete package" by integrating and applying core values and content. We believe that we have always done these well as a field, but it is time to show our value with data. By supporting reading, integration, and contextual learning, you will be of high value in your school. It is vital to understand that, if we reject the concepts of accountability and data-based decision making, and if we decide to teach in isolation, reductions and possible elimination of technology and engineering programs could result.

References

Learning First Alliance. *The No Child Left Behind Act: Key Provisions and Timelines.* www.learningfirst.org/lfa-web/rp?pa=doc&docId=25

USDOE. *Stronger Accountability – Questions and Answers on No Child Left Behind.* www.ed.gov/nclb/accountability/schools/accountability.html

CORD. *What is Contextual Learning* (2005). www.cord.org/what-is-contextual-learning/

NOCTI (2001). *Using Standardized Test Data to Improve Instruction in Career-Technical Education: A Perspective for Practitioners.* www.nocti.org/PDFs/NOCTIWhitePaper.pdf

Joseph C. Panettieri (Feb., 2006). *Special Series Part 1 - Data Driven.* (www.thejournal.com/articles/17864)

Daggett, Willard: *The Future of Career and Technical Education* White Paper. http://daggett.com

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ITEA Member Receives Disney Teacher Award

ITEA member Douglas Dillion, a middle school technology education teacher at Honey Creek Middle School in Terre Haute, Indiana, was chosen from more than 75,000 nominees nationwide to receive the 2006 Disney Teacher Award in celebration of his creativity, innovative teaching methods, and ability to inspire his students.

Their peers—representatives of leading educational associations from across the United States and former Disney Teacher Honorees, select Disney Teacher Honorees. The process includes letters of recommendation from one of the teacher's administrators and one from either a student or parent. Each nominee must also answer four essay questions about classroom practice and environment, creativity while following accountability guidelines, collaboration to improve students' success, and events that have shaped them as a teacher. Honorees come from every subject field and every level of PreK-12 teaching. Dillion is one of three Honorees being recognized for applied fields education.

Typical me while my students are working hard.

As one of only 44 Disney Teacher Honorees, Dillion received $10,000 from Disney and a trip to the Disneyland Resort in Anaheim, California for a week of fun and celebration. In addition, Disney awards $5,000 to Honey Creek Middle School. The Disney Teacher Awards do not simply honor one teacher; they also make an investment in that teacher's educational community. During the week of celebratory events in Anaheim, five exceptional teachers will be chosen from the 44 Honorees. Four Outstanding Teachers and one Disney Teacher of the Year will receive an additional $15,000 from Disney.

In addition to the monetary awards, Disney will also fly Dillion and his principal to the Walt Disney World Resort in Orlando in October for a six-day professional development institute where they can refine their own innovative teaching approaches by sharing ideas and learn how to engage other teachers to build an effective collaborative teaching culture at their school. Once they return, Dillion and his principal will work with experts from the Center for Collaborative Education in Boston to design a school-wide plan for making teaching more effective.

Dillion will take a leadership role, educating his fellow teachers in the creative techniques that have made him so successful at connecting with students. "I plan to use Disney's professional development to help create more standards-based activities that encourage higher-level cognitive skills and don't depend on textbooks," said Dillion.

Some of my students acting like me.

Creativity is key in Dillion's classroom. "Tech Town USA is my most popular activity. Students and their parents start out with homework that gets the parents involved. The students use this homework as research to design their house. They then build a scale model, where creativity is encouraged," he explained. "Finally, they become a realtor and create a realty sheet with price, taxes, size, and persuasive descriptions." The Tech Town USA program has helped Dillion forge a relationship with the Indiana Builders Association, Home Builders Institute, and the National Association of Home Builders.

Douglas Dillion is now forming a foundation to assist middle level technology education and high school career and technology education programs. Initially he hopes to work with Indiana Department of Education technology education specialist and fellow ITEA member, Mike Fitzgerald, to continue to develop technology education curriculum crosswalks activities and then offer standards-based training opportunities for the technology education teachers in Indiana. "Though the initial focus of the foundation will be in Indiana," Dillion said, "It is my hope to continue to foster positive relationships with industry and grow this foundation until it can benefit schools, students, and teachers, nationwide."


Serious working hard.

Approaches to Assessing Technological Literacy

By Greg Pearson
National Academy of Engineering

The challenge of developing assessments for students, teachers, and out-of-school adults in a content area as complex and relatively unknown as technological literacy will be significant.

Some 18 months ago, I spoke before a group of several hundred high-achieving high school students from around the world who were visiting Washington, DC as part of a program called Presidential Classroom (www.presidentialclassroom.org). I chose to talk about technological literacy, since the students' week in DC was focused on science and technology policy. I began with an interactive quiz. I flashed the following question on the screen at the front of the auditorium: "When you hear the word 'technology,' the first thing that comes to mind is '_____.'" After five seconds, I asked those who had thought of "computer" or "computers" to raise their hands. Well over half the group did so.

Two recent Gallup polls (ITEA 2001, 2004) had asked the same question, and nearly 70 percent of respondents also said computers. But participants in those surveys were adults with no particular interest or training in science and technology. This auditorium was filled with teenagers with a keen interest in these subjects. Was their view of technology really so narrow? If it was, what did that suggest? Did it simply reflect the omnipresence of computers and computer-driven devices in these youngsters' lives? Was it a reflection on how we treat (or fail to treat) the topic of technology in our schools? How might this limited conception of technology affect these kids' understanding of other, related issues, such as engineering, innovation, and the nation's R&D enterprise?

The unfortunate truth is that we know very little about what children or adults know, can do, and believe about technology. This is because the state of assessment related to technology—or, better, technological literacy—is in its infancy. That, at least, is the conclusion of the Committee on Assessing Technological Literacy, a study panel appointed by the National Academy of Engineering and the National Research Council. The 16-person committee, chaired by Dartmouth College engineering professor and NAE member Elsa Garmire, spent over two years examining the status and prospects for assessment of technological literacy. Its report, *Tech Tally: Approaches to Assessing Technological Literacy*, was published in July. (The report can be viewed online and copies purchased through the National Academies Press, www.nap.edu.)

In addition to Garmire, the panel included experts in learning and cognition, assessment, informal education, opinion-survey research, and K-12 education reform. Three on the committee—Rod Custer (Illinois State University), Bill Dugger (ITEA Technology for All Americans Project), and Marc DeVries (Eindhoven University, The Netherlands)—represented technology education.

The goal of the project was to determine the most viable approach or approaches for assessing technological literacy in three distinct populations in the United States: K-12 students, K-12 teachers, and out-of-school adults (the "general public"). The National Science Foundation-funded project had two specific objectives:

- Assess the opportunities and obstacles to developing one or more scientifically valid and broadly useful assessment instruments for technological literacy in the three target populations.

- Recommend possible approaches to be used in carrying out such assessments, including the specification of subtest areas and actual sample test items representing a variety of item formats.

In this article, I will describe in general outline the contents of the report, and I will treat in some detail several topics that may be of particular relevance to technology education. Two important clarifications are needed up front. First, the project was not aimed at developing an actual assessment instrument. The committee did review a number of existing assessment tools, however. Second, the focus of the project was on assessment on a scale larger than the individual classroom—as assessment might be done across an entire school, school district, state, or the nation. In other words, the committee did not consider how a teacher might develop an appropriate test for a specific course, lesson, or project. One source of assessment advice for classroom teachers is *Measuring Progress: A Guide to Assessing Students for Technological Literacy* (ITEA, 2004).

Because the report will be read by many people not familiar with the broad view of technology that underpins the idea of technological literacy, the committee spent considerable effort defining technology and making the case for technological literacy and its assessment. To make the strongest case for raising the level of technological literacy, one must first show that the present level is low. This is very difficult to do without a good measure of technological literacy. The report notes that until technological literacy is assessed in a rigorous, systematic way, it is not likely to be considered a priority by policy makers, educators, or average citizens.

The report argues that the development of assessments of technological literacy will benefit a number of groups. One of the most obvious beneficiaries will be the formal-education community. As more and more states move toward adopting technology education standards for K-12

File Photo

students (Meade and Dugger, 2004), schools will have to measure how well they are implementing those standards. Assessments will provide a gauge of how effectively schools promote technological literacy and an indication of where improvements can be made. And for K-12 students to become technologically literate, their teachers must also become technologically literate. Many other institutions and organizations—such as media outlets, museums, government agencies, and associations that represent industries—would benefit from knowing the level of technological literacy of their customers, patrons, or target audiences.

For readers not familiar with the field of assessment, the report includes a primer on assessment terminology and methods. For similar reasons, the report presents basic information about aspects of cognition and learning science that are relevant to test design. And because design is such a central feature of technology and of technological literacy, the committee suggested that following a design process will be helpful to those tackling the task of developing assessments. The report explicitly discusses the concepts of criteria, constraints, and trade-offs in the context of test development.

A key element in the design of assessments for many subjects, such as mathematics and science, is creation of

CONTENT AREAS	COGNITIVE DIMENSIONS: KNOWLEDGE	CAPABILITIES	CRITICAL THINKING AND DECISION MAKING
TECHNOLOGY AND SOCIETY			
DESIGN			
PRODUCTS AND SYSTEMS			
CHARACTERISTICS, CORE CONCEPTS, AND CONNECTIONS			

Table 1. Proposed Assessment Matrix for Technological Literacy

a so-called conceptual framework. Frameworks describe the main ideas to be tested, suggest the cognitive abilities required, and propose how test items are to be allocated according to the various areas of content, item types, and student grade levels. This is the process followed by the National Assessment of Educational Progress (NAEP), which conducts large-scale national assessments, as well as by most states, and it is one endorsed by the committee for technological literacy. *Tech Tally* does not contain an actual framework; this work will need to be done by others. But the report does propose a way of organizing the content of technology and the cognitive dimensions of technological literacy (Table 1). The content areas are derived from ITEA's *Standards for Technological Literacy: Content for the Study of Technology* (ITEA, 2000/2002), and the cognitive dimensions are adapted from *Technically Speaking: Why All Americans Need to Know More About Technology* (NAE and NRC, 2002).

As part of its research, the committee collected and reviewed 28 assessment instruments that in one way or another touched on technological literacy, even if that was not their explicit aim. Not surprisingly, the majority of instruments—about half—targeted students; a third focused on what out-of-school adults know and believe about technology; and just two were aimed at discerning what teachers know and can do. A handful of the student assessments were developed by technology educators (Pearson, 2004). Overall, the committee found that none of the collected instruments were adequate to the task of assessing technological literacy as described in *Technically Speaking*. This is not surprising, since the view of literacy presented in *Technically Speaking* did not directly inform any of the collected instruments. The committee noted that the paucity of appropriate assessments should not be seen as evidence that assessments of technological literacy cannot be developed.

The challenge of developing assessments for students, teachers, and out-of-school adults in a content area as complex and relatively unknown as technological literacy will be significant. *Tech Tally* suggests two main areas of opportunity: integrating technology-related questions into existing assessments in other subject areas, such as science; and creating de novo assessments devoted exclusively to technological literacy. For students, the committee recommended that technology items be added to the NAEP science, mathematics, and history assessments and the international comparative Trends in Mathematics and Science Study and Programme for International Student Assessment. The committee charged the NSF with funding research to design and test stand-alone assessments for students.

The report suggests that all teachers, not just technology teachers, be assessed in some way for their technological savvy. The committee recommended that provisions related to teacher quality in the federal No Child Left Behind Act be used to introduce technology-related items for teachers of mathematics, science, history/social studies. *Tech Tally* calls on NSF and the Department of Education to develop new, sample-based assessments of preservice and in-service teachers—including technology educators—and it says the results of such testing should be disseminated to schools of

education, curriculum developers, state boards of education, and other groups involved in teacher preparation and teacher quality. In sample-based assessment, individual test scores typically are not reported. The committee recognized that this last recommendation could face resistance from teachers and teacher unions concerned about privacy and the misuse of test data.

One issue not directly addressed in the report relates to the question of how technology teachers might stack up against teachers of other subjects if all were given the same assessment. Depending on the results, the outcome of such a comparison could either be very positive or very negative for the field of technology education. A reasonable assumption is that technology teachers are, by virtue of their training, among the most technologically literate of K-12 teachers. The only assessment instrument examined by the committee that probed technological knowledge of teachers, the Praxis exam, did little more than require identification of basic concepts and definition of terms, according to the committee. If an assessment were developed that addressed higher-order thinking and problem solving, even technology educators might find themselves challenged.

Tech Tally, like other reports, suggests that there is a dearth of information about precisely how people learn technological concepts. A clear idea of the cognitive processes involved in learning is crucial to the development of assessments and the interpretation of the results (NRC, 2001). The committee made several recommendations intended to spur new research in this area, including calling on NSF to support graduate and postgraduate research related to how students and teachers learn technology and engineering concepts.

Altogether, the report makes twelve recommendations addressing five areas: instrument development, research on learning, computer-based assessment methods, framework development, and public perceptions of technology. It is an ambitious agenda that will require sustained effort by many stakeholders to be carried out successfully.

Tech Tally notes that the impetus for technological literacy is a desire that all citizens be empowered to function confidently and productively in our technology-dependent society. If we could assess technological knowledge, capability, and critical thinking skills in a rigorous and systematic way, it argues, we could track trends among students, teachers, and out-of-school adults. Reliable information would enable policy makers, educators, the business community, and others to take steps to improve the situation if necessary. Movement toward a more technologically literate society would then be directed and purposeful, governed by data rather than anecdotal evidence and educated guesses. Over a period of many years, with considerable investment of human and financial resources, the benefits of technological literacy would be realized.

References

ITEA (International Technology Education Association). 2000/2002. *Standards for technological literacy: Content for the study of technology.* Reston, VA: Author.

ITEA. 2001. *ITEA/Gallup poll reveals what Americans think about technology. A report of the survey conducted by the Gallup Organization for the International Technology Education Association.* Available online at www.iteaconnect.org/TAA/PDFs/Gallupreport.pdf. (October 5, 2005).

ITEA. 2004. *The second installment of the ITEA/Gallup poll and what it reveals as to how Americans think about technology. A report of the second survey conducted by the Gallup Organization for the International Technology Education Association*. Available online at: www.iteaconnect.org/TAA/PDFs/GallupPoll2004.pdf. (October 5, 2005).

ITEA. 2004. *Measuring progress: A guide to assessing students for technological literacy*. Reston, VA: Author.

Meade, S.D. & Dugger, W.E., Jr. 2004. Reporting on the status of technology education in the United States. *The Technology Teacher*. *63*(2): 29-35.

NAE and NRC (National Academy of Engineering and National Research Council). 2002. *Technically speaking: Why all americans need to know more about technology*. Washington, DC: National Academies Press.

NRC. 2001. The Science and Design of Educational Assessment. Pp. 44-51 in *Knowing What Students Know*. Washington, DC: National Academy Press.

Pearson, G. 2004. Assessment of technological literacy: A National Academies perspective. *The Technology Teacher* *63*(7): 28-29.

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Becoming a Reflective Technology Teacher

By Cynthia Evans

The more I reflected, the better I was able to meet the students' needs.

How many technology teachers reflect on their teaching each and every day? How many technology teachers ask themselves the hard questions surrounding student learning and their own teaching? How many technology teachers ask their students for feedback on a daily basis? The purposes of this manuscript are to share a personal story about reflective teaching, provide examples of how being a reflective teacher will improve student learning, how to modify classroom initiatives based on reflections, and most importantly, how to improve the teaching of technology.

Background

After being given the assignment to be the instructor for the Teaching Transportation Technologies course at Illinois State University for the fall 2005 session, I, along with my co-instructor, decided to revamp the course curriculum to include a series of reflective components for both the students and the instructors. At least once a week, the students had a chance to reflect on the material being delivered through discussions and personal journals. These reflections were meant to help the students further understand the course material and think about how they would implement the information into their future classrooms. As the instructor, I kept a journal of each day's lesson and a reflection of my thoughts of the day. I used this journal to help guide the lessons that followed to improve the quality and delivery of the material, as well as my own teaching.

Student Reflection

The format of the class was divided into four components for each unit of instruction: **C**ontent/Methodology, **A**ctivity, **R**eflection, and **T**eam Teaching/Reflection (CART). As each unit progressed, the students had multiple opportunities to think about how they would deliver the presented material

in their classrooms. Each unit started with the **C**ontent/ Methodology component of the CART method. This component was used to introduce the students to different teaching methods and the content of the transportation unit.

The instructors then presented a content-related **A**ctivity to the content to the students, demonstrating the teaching method discussed in the first component. At the conclusion of the activity, the students were given their first reflection of the unit. The students were given the following two main questions to answer for the unit activity: What were the strengths and weaknesses of this lesson? and What would you change about the lesson? Other questions were also added to the activity depending on the material covered in the lesson. These questions were answered on paper and turned in to the instructors.

Once the students had completed this assignment, the class moved on to the **R**eflection component of the unit. This component was often an informal discussion about the enduring understandings, teaching methods, interdisciplinary subjects, and the strengths and weaknesses of the lesson; the students were encouraged to freely voice their opinion of the lesson. This discussion allowed the students to talk about the strengths and weaknesses of the lesson as well as providing them an opportunity to discover ways to adjust a lesson to improve the overall design.

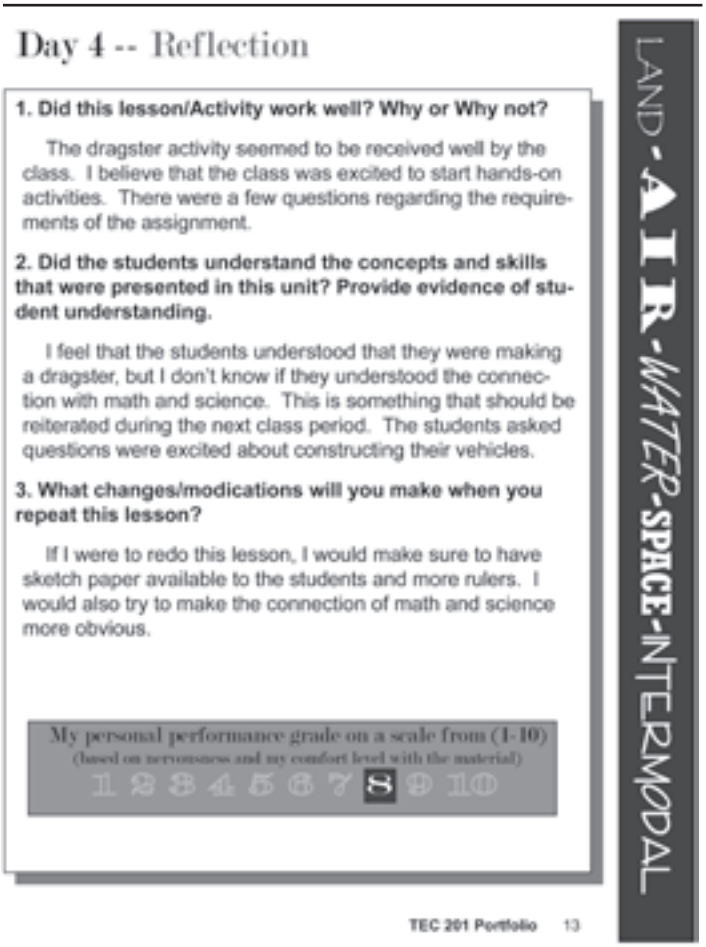
The final component, **T**eam Teaching/Reflection, provided the students an opportunity to develop and implement a lesson related to the transportation unit. Much like the **A**ctivity component, the student lesson plan included a reflection component for their peers to fill out about the strengths and weaknesses of the lesson. The team-teaching group also had to submit a personal reflection of the lesson based on a series of three questions. The questions were: What do you think are some of the positives and negatives of using a cooperative learning approach? How did your team decide to incorporate an interdisciplinary approach? and How would you incorporate what you learned developing and delivering this lesson into your teaching?

Before the unit was concluded, the class would again participate in an informal discussion about the enduring understandings, teaching methods, interdisciplinary subjects, and the weaknesses and strengths of the team-teaching lesson. This allowed the class to continue thinking about how they would implement material into their classrooms and how they might improve the lesson for future classes. Once this reflection component was completed, the class would move to the next unit and repeat the entire process.

Instructor Reflection

With the changes made to the curriculum for the course, it was important to be able to judge the outcome of the student performance. Since this was a new teaching approach, I also wanted to rate my personal performance as the instructor. I rated myself on a scale from 1-10, with one being a poor performance and ten an excellent performance. By keeping a reflective journal of each day's lesson, I had the ability to see what I did well and what I still needed to work on to better assist in student learning. Figure 1 is a sample page of the reflection journal I created for the course.

The journal helped me to become a better instructor for the course; the more I reflected, the better I was able to meet the students' needs. The personal reflection helped the



Day 4 -- Reflection

1. Did this lesson/Activity work well? Why or Why not?

The dragster activity seemed to be received well by the class. I believe that the class was excited to start hands-on activities. There were a few questions regarding the requirements of the assignment.

2. Did the students understand the concepts and skills that were presented in this unit? Provide evidence of student understanding.

I feel that the students understood that they were making a dragster, but I don't know if they understood the connection with math and science. This is something that should be reiterated during the next class period. The students asked questions were excited about constructing their vehicles.

3. What changes/modications will you make when you repeat this lesson?

If I were to redo this lesson, I would make sure to have sketch paper available to the students and more rulers. I would also try to make the connection of math and science more obvious.

My personal performance grade on a scale from (1-10)
(based on nervousness and my comfort level with the material)
1 2 3 4 5 6 7 8 9 10

TEC 201 Portfolio 13

LAND-AIR-WATER-SPACE-INTERMODAL

Figure 1. Sample page.

course run much more smoothly toward the end of the semester. I also learned a lot about myself as a person and as a teacher. The journal was extremely useful after both the **R**eflection and **T**eam Teaching/Reflection components. I would enter much of the information the students presented in class into the journal to help me improve the lesson for the next class.

Teacher Tips

Although this method was used in a teacher-preparatory course, this reflective approach could easily be implemented at any level. Have the students in your class complete a one-minute paper about what they liked and disliked about the lesson, what they learned and did not learn during the lesson. While students are completing their papers, ask yourself a series of general questions about the lesson and student performances. These questions could include: How well do you feel the students understood the concepts presented in class? Did the lesson go as planned? Why or why not? and What changes would I make the next time I teach this lesson? Keep a journal/binder with the student comments and your own thoughts on the lesson/unit. By having these reflections on hand, you will be able to adjust the unit easily to improve student performance.

Cynthia Evans *received her MS in Technology Education in December 2005 and has accepted a teaching position at Evanston Township High School in Evanston, IL for the 2006-2007 school year. She can be reached via email at cindymevans@gmail.com.*

Ad Index

Super Mileage Challenge: Combining Education and Fun!

By Jim Thompson and Mike Fitzgerald

The Super Mileage Challenge teaches students to research, design, and construct futuristic vehicles while applying advanced topics in math, science, technology, and engineering.

Super Mileage participants.

Introduction

With the rising price of fuel and increased concerns for the environment, achieving maximum gas mileage continues to be a very important topic. Today, in an exciting student competition, Indiana students seek solutions by applying technology, innovation, design, and engineering. IMSTEA, the organization sponsoring the event, is a non-profit, all-volunteer organization dedicated to improving the mathematics, science, and technological literacy and competency of all Hoosiers. It was founded in 1990 and continues to pursue this goal today.

Beginning in 1996, key leaders in Indiana business, education, and industry, along with the Department of Education and the Indiana Math Science Technology Education Alliance recognized that creating an event that would showcase true integration of mathematics, science, and technology could make learning more relevant to the lives of students. The result is the highly successful Indiana Super Mileage Challenge.

The SMC is a high school competition providing students with the unique opportunity to combine theoretical aspects of mathematics, science, and technology with practical experience in the design, engineering, fabrication, and testing of an actual vehicle. For the past 11 years, students from across Indiana have been "challenged" by the SMC. They work throughout the school year to design, build, and improve vehicles. They then test the prototypes in competition each year at the NHRA's O'Reilly Raceway Park oval. This highly competitive event features innovative student solutions for achieving optimum mpg. Student teams design a one-person, fuel-efficient car powered by a single cylinder, four-cycle engine. The 2006 Unlimited Class Champion is William Henry Harrison High School, of Lafayette, Indiana whose team achieved 1060.30 mpg. The

Stock Class Champion was Mater Dei High School of Evansville, Indiana with 1241.76 mpg.

It All Begins in the Fall

Each year the SMC season begins with a letter of intent to participate that is sent to schools across the state. The responding schools are sent a copy of SMC rules and directions to the IMSTEA website at www.imstea.org. They are also offered guidance (especially needed by new teams) on how to get started. Finally, the schools are provided with the deadlines for submission of design proposals, the tentative date of the event, and any other necessary technical support that may be needed.

Often, a new team may want to visit an experienced team near their school for help. This is often the best way to start. A mentor team can provide much support. New teams often learn that guidance and assistance from mentors can be very valuable in building a successful entry.

Schools may have up to two entries each year, one in the stock class and one in the unlimited class. The stock class is based on engines provided by Briggs & Stratton Corporation. The engines are then sealed by IMSTEA officials. The unlimited class allows schools to modify the engine as long as it meets certain specifications. IMSTEA rules governing the cars and allowable modifications are provided in the rules package sent to each school. Many schools compete with both a stock-class vehicle and an unlimited-class vehicle. It is important to note that a school may not elect to enter into the unlimited class until after they have successfully competed in the stock class for one year.

Working Through the Winter

After schools have elected to participate, the portfolio season starts during the fall and the early winter months. Teams begin the design, marketing, and construction of their vehicles. Some schools do their work as part of their curriculum, whereas most conduct the work as a co-curricular or club activity. Students work to learn the rules, gain sponsorships, research, locate parts, and learn how to design in CAD or 3-D CAD programs, and most importantly, how to document their work through a design proposal.

The design portfolios/proposals serve two purposes. First, the portfolios provide the necessary information and documentation needed by the IMSTEA competition committee in order to determine that the vehicle design conforms to the rules. Second, the design proposal ensures that the entry is a result of a genuine design effort by teams. During the winter months, the teams design and construct many of the basic systems and subsystems. The design proposal requires that the student teams document the following:

- Vehicle design concept
- Frame/chassis
- Body
- Drive train
- Braking system
- Steering system
- Safety systems
- Aerodynamics
- Cornering forces
- Braking distance calculations
- Rolling friction calculation
- Performance prediction
- Accessories and instrumentation
- Cost estimate/bill of materials

Portfolio Review

In mid winter the IMSTEA Executive Competition Committee meets to review the portfolios. The team, representing business, industry, and education, studies each portfolio to determine if the conceptual design meets the minimum requirements of the competition. Those proposals meeting the requirements are approved as written or approved pending submittal of clarification in questionable areas.

The reviewing team recognizes that the proposals are for a design concept and that often the concept may not reflect the vehicle as it is actually built. The SMC rules require teams to present documentation of changes from the original concept at the time of technical inspection. The more experienced teams often begin construction of their vehicles prior to submitting their portfolios since the rules do not change significantly from year to year. Technical inspection insures that the teams are in compliance with the rules prior to participation in the event at Indianapolis O'Reilly Raceway Park.

During the portfolio review, the most prestigious awards of Best Integration of Math, Science, and Technology and the Best Design Proposal are determined. IMSTEA's intent since the beginning has been to emphasize what the students learn as much as what mileage their team achieves. Often the teams with the best mpg are also the teams with the best design portfolios. The teams finish the winter months by preparing for technical inspection, which is held the day before the event at Vincennes University's Aviation Technology hanger at the Indianapolis International Airport.

Technical Inspection

The day before the event, participating schools present their cars for a thorough technical inspection to verify conformance with the rules of the competition and to insure the vehicle is safe for operation on the track. For the past two years, Vincennes University has hosted this part of the competition and provided a dinner for the participants. Vincennes University is also a major financial sponsor for the Super Mileage Challenge. Items inspected include:

- Braking system – for ability to stop the car in the required distance.
- Stability – to test the ability of the car to withstand the banking at the track.
- Emergency exit – to insure the driver can exit the car quickly in the event of an accident.
- Safety equipment – mirrors, fire extinguisher, ventilation, kill switches, etc.
- Turning radius – to insure the car can maneuver properly.
- Helmets – for conformance to national standards.
- Conformance to rules – frame and body construction, engine modifications, steering system, etc.

Cars successfully completing this inspection are given a sticker certifying that they meet technical and safety standards. No car is allowed on the track without this sticker. For the past two years, Vincennes University has provided staff from the school of technology and the aviation technology center for the technical inspection.

Race Day

Competition starts early at Indianapolis O'Reilly Raceway Park. Drivers and crew chiefs must attend a mandatory safety meeting at 7:30 a.m., and the track is opened for runs at 8:00 a.m. Each run lasts 10 laps at an average of 15 miles per hour or higher. Most cars try to come as close to the minimum 15 mph speed as possible. Fuel tanks are weighed before and after each run, and the weight difference is used to calculate the mileage. Teams may make as many runs as they wish during the day, and the best three attempts are averaged for their official score.

In 2006, 49 schools submitted entries for the challenge, and 38 schools brought 45 cars to the event. The field included 35 Indiana high schools, one high school from Illinois, and two college entries. The college entries were not eligible for awards. There were 27 cars in the stock class and 18 in the unlimited class. Eleven schools created cars for both classes. Awards were given to the team with the best score in the race as well as for best integration of mathematics, science, and technology into the design and construction of the vehicle, best design, craftsmanship, sportsmanship, teamwork, and closest to estimated performance.

Conclusions

Each year the teachers and students rate their participation in the Super Mileage Challenge as one of the best learning experiences of their high school years. Alumni of this event often go on to pursue engineering, technical, or scientific degrees in college. The skills that students gain through participating in the Super Mileage Challenge are hard to measure. Not only do students learn how to apply math, science, technology, and engineering, they also learn teamwork, problem solving, and leadership skills. The IMSTEA Super Mileage Challenge helps aim students today for the careers and challenges of tomorrow.

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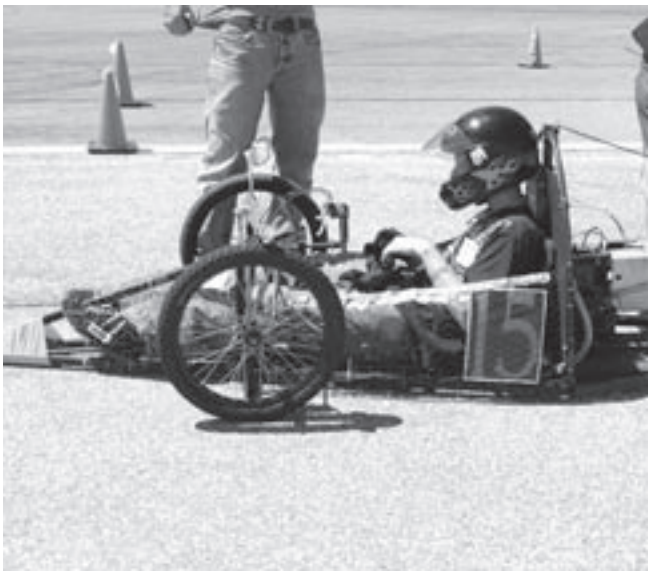
Web Resources

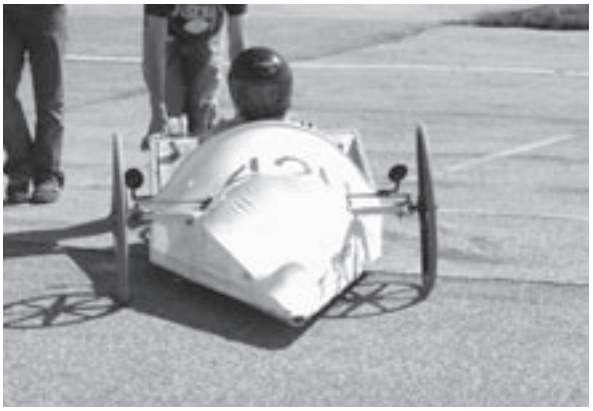
- Indiana Math Science Technology Education Alliance Web Page www.imstea.org
- 2006 IMSTEA SMC Slide Show www.aviationtechcenter.com/imstea.htm
- 2006 IMSTEA Super Mileage Challenge Results www.doe.state.in.us/octe/technologyed/pdf/IMSTEA%20RESULTS.pdf
- IMSTEA Super Mileage Challenge www.doe.state.in.us/octe/technologyed/SuperMileageChallenge.html
- Senator Richard G. Lugar, United States Senate IMSTEA SMC letter www.doe.state.in.us/octe/technologyed/pdf/SMClugar.pdf

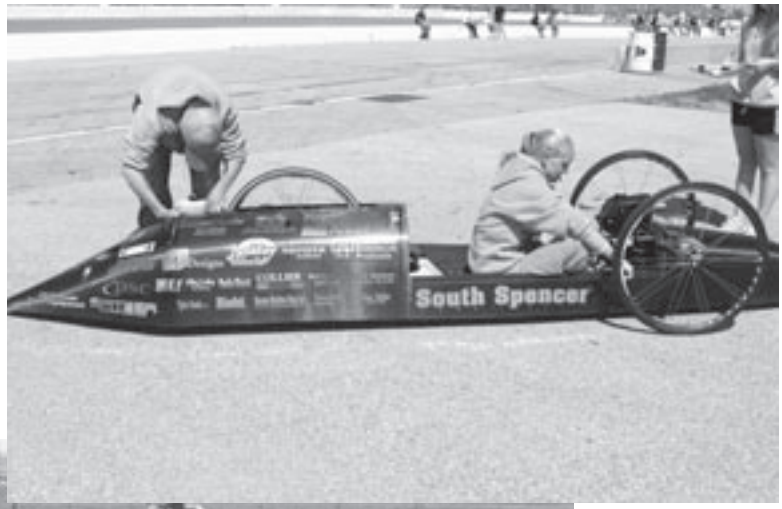
School Website Resources

- Winamac High School: www.epulaski.k12.in.us/tech/hs/mileage.htm
- Mishawaka High School: www.mishawaka.k12.in.us/mhs_files/Departments/technology/MHSengineering/index.htm
- Albany Area Schools: www.albany.k12.mn.us/supermileage.html
- Bosse High School: http://bhsrunner0.tripod.com/id5.html
- Delta High School: www.delcomschools.org/dhs/SuperMileage/super_mileage.htm
- Ensweiler Academy Super Mileage Challenge: www.khwisdom.com/scienceclass/page8.html
- Mishawaka High School: mhsengineering.com/2003MPGvehicle/config.htm

Super Mileage Challenge: Combining Education and Fun!



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