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As we prepare for the start of the new school year, I thought a survey of some cool technology and career and technical education-related activities that occurred over the summer might interest Tech Directions readers.

One of the most prestigious was a camp sponsored by the U.S. Naval Academy that got 100 7th- through 10th-graders from across the country excited about STEM (science, technology, engineering, math). The students participated in a variety of hands-on activities involving robotics, mechanics, and biometrics, along with other fields. A participating electrical engineering educator said the camp increases students’ interest in STEM by showing them what they can do with it. Affirming feedback from an 11-year-old camper: “You get to do a lot of hands-on things. It’s definitely furthering my interest.”

Kalamazoo (MI) Community College’s “Steel My Summer” program gave students a chance to explore the world of manufacturing by building scale model cars and visiting local industries. The college’s dean of advanced technology says the program’s purpose is to “expose students to industrial trades and the technical field . . . get them excited about technology and manufacturing.” Students machined many parts used in the remote-control cars and were introduced to CAD, metal shearing, and assembly processes. They also got demonstrations of the college’s programs in welding, machining, drafting, material science, HVAC, automotive, and electrical technology.

To address the coming shortage of workers in the engineering, construction, and manufacturing industries, the Contra Costa (CA) County Office of Education held a week-long camp at which high school juniors and seniors built a shed, made composite cement, and took field trips to an electrical workers training center, a construction site, and a steel fabrication facility. Said one camper: “I wish I could stay the whole summer.”

And as further indication of just how motivating our fields of education can be, note the experience of students at Frontenac (KS) High School. Construction students there started work last spring on a shed for storing materials for the construction program. They failed to finish the project before the school year ended, but the construction technology teacher, Lynn Hoover, reported that many students volunteered to work with him throughout the summer to get the job done. Why would students return to finish a class project if there’s not class? “It’s a hands-on activity,” said Hoover. “Kids can take pride that they have built this and that it will be here for years to come.”

Technology and career and technical education—educating students about the technological world, preparing them for rewarding careers, keeping them motivated. Welcome back!
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CAD students design, build, document, and test electricity-powered incline-climbing vehicles. A great activity for transportation, manufacturing, and introduction to technology classes, too.

RESCUE ME!

Fifth Annual Inventor’s Competition—The Great Milk Carton Challenge

The car on this month’s cover, called the MiniCat, runs on compressed air. The inventor, Guy Nègre, stands beside it. See “Technology Today” (page 11) for the details. Photo courtesy of MDI Enterprises S.A. Cover design by Sharon K. Miller.

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More on Improving CTE

Following a multi-state analysis of state policies that could improve career/technical education (see “Direct from Washington,” May 2008), the nation’s chief state school officers have outlined how to make career and technical education (CTE) more rigorous across the country. Their report, prepared by the Southern Regional Education Board (SREB), focuses on bringing programs funded by the Perkins Act into alignment with state efforts on high school reforms.

The Perkins Act now requires CTE programs to emphasize academic skills. This fits with efforts by state governors to strengthen high school instruction so that all students are prepared for college or workplaces that offer stable, family-supporting incomes. The report also underscores a renewed interest by state policy makers in finding alternative ways to encourage students to complete a high school diploma. Career paths are becoming popular again.

For the rest of this item, visit www.techdirections.com/w081.html.

Career Academy Successes

The nation is searching for strategies that work for young minorities, especially black men, so the latest report on career academies is welcome news. MDRC (Manpower Development Research Corp.) evaluated career academies since 1993, using random assignment research techniques. The most recent report focuses on how career academies have influenced labor market outcomes of participants eight years after they would have been expected to graduate from high school. The study involved 1,400 students, primarily Hispanic and black.

Career academy members’ earnings averaged 11 percent more per year than those in the nonacademy group. They averaged almost $2,100 more per year, or more than $16,700 over the eight years. This result was most evident for young men, even though this group has experienced a real decline in earnings for many years. For them, the added benefit of academy experience increased their earnings by 17 percent, or almost $30,000 over the eight years.

For the rest of this item, visit www.techdirections.com/w082.html.

Harsh Realities in the World of Work

Honesty is the best policy, perhaps, so it might be wise for career educators to be brutally frank with their students: it is really tough out there in the work world. Two new reports about jobs and earnings add to data already dryly put in income and employment statistics—all of them adding up to a bleak picture for those who don’t have skills that can be built on in high-demand occupations. Or, who live in states with high percentages of “bad jobs.”

One study, by the Center for Economic and Policy Research, uses a different measure of economic security than that used by the federal government. Instead of the poverty line, which many economists view as unrealistic, the Center uses basic budget data on the actual costs of goods and services needed for a decent standard of living, taking into account geographic variations. Its calculations also take into account the value of all public work supports to helping families make ends meet. Moreover, its definition of a “good job” goes beyond pay (minimum of $17 per hour) and includes an employer-sponsored health plan (where the employer pays at least part of the monthly premium) and an employer-sponsored retirement plan.

For the rest of this item, visit www.techdirections.com/w083.html.

Call for Increased Funding for Training

While young people may not know the details of government spending, their sentiments in poll data might reflect the realities of decreasing support. According to the Center for Law and Social Policy, federal investments in employment and training programs have declined in real terms by almost 70 percent since 1979, which was the peak year under the Comprehensive Employment and Training Act. This is now the Workforce Investment Act, but it does not require any funds to be spent on training.

For the rest of this item, visit www.techdirections.com/w084.html.

Anne Lewis, one of the country’s most respected writers on education policy, works in the Washington, DC, area.

Editor’s note: Due to rising paper and postage costs, we’ve placed portions of this column on our web site. We welcome your reactions.
NCCER Announces Fourth Annual Careers in Construction Week

The National Center for Construction Education and Research (NCCER) announces that the fourth annual Careers in Construction Week will take place Oct. 13-17, 2008. Careers in Construction Week is designed to increase public awareness of the hard work and contributions of our nation’s craft professionals. In addition, the week promotes recognition among parents, teachers, guidance counselors, and students of the rewarding career opportunities available in construction.

“2007 was a success,” said Don Whyte, NCCER president. “Thirty-eight governors proclaimed Careers in Construction Week in their state and the week received recognition from the White House. We encourage contractors and schools to use this week to honor our craft professionals and recognize construction as a rewarding career.”

During this week, NCCER will also broadcast the 2008 Build Your Future career awareness video. The video is distributed free of charge and features interviews with craft professionals who are already experiencing a rewarding construction career. Contractors, schools, and industry associations throughout the country will conduct career fairs and various construction-related activities to help promote construction career opportunities in their communities.

NCCER provides an array of promotional materials to assist organizations in planning a successful week. Materials include sample press releases, logos, proclamation templates, and suggested week activities. All materials are available for download from the NCCER Careers Web site at careers.nccer.org.

Student Auto Skills Competition Winners Announced

The winners of the national final of the Ford/AAA Auto Skills competition, which took place June 24 in Dearborn, MI, have been announced. The top three teams are:

- First place—Paul Bretl and Chris Cheek, Grafton (WI) High School; Carl Hader, instructor
- Second place—Zachary Bryant and Cory Zamenski, Eastern Technical High School, Baltimore, MD; Eldridge Watts, instructor
- Third place—Taylor Morehouse and Kevin Podvin, Sheyenne Valley Career and Tech, ND; Jim McFadgen, instructor.

The competition is cosponsored by Ford and AAA. Susanne Peckham is managing editor of Tech Directions.
by AAA and Ford Motor Co. It aims to encourage talented young people to pursue careers as automotive service technicians.

The nationwide competition is for 11th- and 12th-grade students in secondary schools and colleges (serving local high schools) that offer courses in automotive technology and have at least one full-time or part-time automotive instructor. Schools may enter a team of 2 to 10 students per full-time automotive instructor.

Each participating instructor selects his or her best auto technology students to take the state qualifying exam, which is taken online and administered by a test administrator at the school. The combined score of the two-highest scoring students from each school becomes the team score and counts 40 percent in the state finals.

In most states, the 10 teams scoring highest on the state qualifying exam then move on to the hands-on state finals scheduled each year in late April or early May, where new vehicles are uniformly “bugged” so that each team has identical malfunctions to diagnose and repair. The competition requires repairs to be made with the highest quality workmanship in the least total time.

The winning two-person team from each state and their instructor are provided expense-paid trips to the national finals in June. Each member of the 50 state teams takes a written exam, and errors on the written exams are converted into time demerits that are added to the team’s time on the hands-on mechanical competition in both the state and national competition.

Each vehicle in the competition is supervised by a team judge who supplies new parts upon request. When a team believes it has returned its vehicle to normal working order the hood is closed, signaling the timer to stop the team’s clock. The team and its judge then take the vehicle on a short road test. The team may then return the vehicle to its work area for further diagnosis and repair, or proceed to final judging.

The team with the fewest quality-of-workmanship demerits and the best combined total score of repair time and written exam is declared the winner.

Students, instructors, and schools win savings bonds, scholarships, trophies, jackets, certificates, shop manuals, trips, and automotive equipment for their schools. Also, the names of all contestants are submitted to Ford Motor Company dealers, AAA-affiliated service facilities, and many other sponsoring organizations that have a need for auto service specialists.

Visit www.autoskills.com for information on participating. Closing date for applying for the competition is December 1.

Events

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Dymaxion House

While designing structures for his father-in-law in the 1920s, Fuller worked on the development of affordable single-family housing using mass production methods. His ideas were just concepts on paper in 1929 when the Marshall Field and Company department store in Chicago had a futuristic furniture display. The store’s marketing department coined the word Dymaxion and included Fuller’s idea for advanced design houses in their promotion. Marshall Field copyrighted Dymaxion in Fuller’s name.

Fuller’s aluminum, circular-shaped house, with wedge-shaped rooms, hung from a central mast. The house could be disassembled and placed in a tube 16’ long by 5’ in diameter. The tube could be shipped by air, water, or road.

In 1944, Fuller convinced the Beech Aircraft Corporation of Wichita, KS, to produce prototypes. Beech built aluminum airplanes and its facility had the tooling necessary to manufacture Dymaxion houses. There were some production disagreements between Fuller and Beech, and, as a result, only two prototypes were made. The same person purchased both and combined them for his private residence. His family donated it to the Henry Ford Museum in Dearborn, MI, where the restored house is on public display.

The six-room polished-aluminum house had 1,100 square feet of floor area, which was about the same size as the houses it was designed to replace. The floor beams hung 18” off the ground in cantilever fashion from a 6’-dia. central mast. The mast contained all major plumbing and electrical wiring components. Fuller made the house circular to minimize the amount of construction materials while maintaining strength and mobility. All-around Plexiglas windows added an expansive feeling.

Most of the structure was held together with threaded fasteners and aircraft-quality cables. A swiveling ventilator at the top provided an air flow pattern that kept moisture from condensing on the walls. Had it gone into production, the Dymaxion house’s 1946 price was expected to be $6,500.

Dymaxion Automobile

Not content to stay with housing, Fuller’s expansive mind moved into the transportation field. He rented an industrial building in Bridgeport, CT, to conduct experiments with molded shapes. Fuller and his staff of 27 developed a streamlined teardrop-shaped car body with a fully encased underside.

His three-wheeled Dymaxion car had front-wheel drive with steering at the single rear wheel. The rear wheel pivoted 90°, which allowed the car to turn on its own axis. The powerplant was a 75 hp Ford V-8 engine with a fuel economy of 25 to 30 miles per gallon. The car could carry 11 passengers and was a uniquely safe vehicle for the time. It featured a chassis of chrome molybdenum steel, wrap-around bumpers, and shatterproof glass. Over 19’ long, the sleek car appeared at Chicago’s 1933 Century of Progress World’s Fair, though it never caught on with the public. Only three handmade Dymaxion cars were produced, and No. 2 is on display at the National Automobile Museum in Reno, NV. The fate of cars Nos. 1 and 3 is unknown.

Fuller was an original thinker who also developed a Dymaxion map of the world. He received 28 patents and wrote over two dozen books. After his death at 87, he was eulogized as a “poet of industrialization.”

References

Dennis Karwatka is professor emeritus, Department of Industrial and Engineering Technology, Morehead (KY) State University.
Running on Hot Air?

The topic for this month’s column percolated out of a message about the air car from a Tech Directions subscriber. Before you read the rest of the column you might want to view the video he referred to at www.youtube.com/watch?v=QmqpGZv0YT4.

After watching the video, my initial impression was that the two technologies it shows were interesting and might be environmentally friendly. These air-drive technologies could power future U.S. golf carts, forklift trucks, and a new type of shared rental or ownership Pod car for transportation within amusement parks or other types of closed communities. But when you add the weight necessary to make this vehicle U.S. road worthy, in its present design you would need tanker-sized compressed air cylinders to hold enough energy to move the vehicle a viable distance. Anyone espousing this technology in its present design as a near-future replacement for the internal combustion engine is, at least in my opinion, full of hot air.

However, with gas prices inching toward $5 per gallon, everyone is now very interested in inexpensive and environmentally friendly alternatives to gasoline-powered vehicles. When I Googled “Blogosphere Air Car,” I found so many people with so many opinions that I concluded that the topic is the perfect opener to a good classroom discussion on the future of the automobile. After research on the topic, students could build their own compressed-air vehicles. Grade level could determine if the compressed air would be contained in a balloon, an air tank, or something more exotic.

In the real, commercial world, Stephanie Lardon, the executive assistant to Miguel Celades, chief executive officer of Air Car Factories S.A., has informed me that the air car designed by Guy Nègre has hit a speed bump. Her exact words, "because of disagreements concerned with the current commercial policy of Guy Nègre, we have decided to discontinue the representation of MDI Enterprises S.A. [Nègre’s company].”

Nègre’s original design, shown in the video, has compressed air directly pushing the pistons on a small 80-pound engine. The video didn’t mention whether the car would have air conditioning. The design actually calls for the use of exhaust air from the car’s engine to cool the passenger compartment. It sounds crazy, but you must remember that this car’s exhaust is free of pollutants since its fuel is atmospheric compressed air.

To energize air enough to power this vehicle, Nègre is compressing the air to 4,350 lbs. and storing it in specially designed carbon fiber cylinders. You don’t break any laws of thermodynamics when you change one form of energy, say electricity, into another form of energy, in this case, stored compressed air. You also don’t get more energy out than you used to perform the compression.

So how environmentally friendly is Nègre’s compressed air car? It depends on what power source is used to compress the air. If your electric pump receives its electricity from a coal-fired power plant, the car in the end is not so environmentally friendly. If your power source is solar, wind, or a new regenerative energy system, your vehicle is totally green.

Guy Nègre’s air car is still a work in progress. If you go to his web site, www mdi.lu, you will see that he is now considering turning his pure air car into an air-gas hybrid. Such a hybrid, if it is a fuel miser, could change the future direction of the automobile. Please note that the web site is in French, but Google is ready to translate its content into English for you.

Recalling the Facts

1. If a vehicle’s exhaust doesn’t contain any air contaminants, should the car automatically be labeled environmentally friendly? Why or why not?

2. An air-gasoline engine hybrid would eliminate the battery storage system found on today’s gas-electric hybrids. Do you think that an air-hybrid car will soon appear and prove superior to current hybrid technology? Why or why not?

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Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.
The Latest in the Web Browser Wars

If you’re like most people, you’re probably using the web browser that came with your computer. The market share of web browsers today bears that out. Microsoft’s Internet Explorer controls 74.9 percent of the market, while Apple’s Safari controls 5.7 percent, according to Net Applications of Aliso Viejo, CA.

Companies over the years, and continuing to the present, have been fighting tooth and nail to get you to use their browser, with Microsoft being the most aggressive—even to the point of getting into antitrust trouble in the U.S. and abroad. Microsoft made it impossible for other browser developers to compete with it when the software behemoth included its own browser with Microsoft Windows and prevented computer companies from including competitive browsers if they wanted to be able to offer Windows on their PCs.

Internet Explorer was able to reach a peak of 96 percent of the browser market in 2002, but Microsoft was found guilty of monopolization and violation of the Sherman Act in United States v. Microsoft. The company escaped being split up, but it was forced to permit greater competition.

The Competition. The main competition today comes from Firefox (www.mozilla.com/en-US/firefox), a product of the nonprofit Mozilla Foundation and the spiritual descendant of the original graphical web browser, Mosaic, introduced in 1993. Despite the fact that it typically must be downloaded and installed, Firefox currently has 17.3 percent of the market, according to Net Applications.

Firefox runs on various versions of Microsoft Windows as well as Mac OS X and Linux, and, like Internet Explorer and Safari, it is free.

With free web browsers doing their jobs as well as they do, programs you need to pay for have had a hard row to hoe. The leading commercial browser, Opera (www.opera.com), controls a scant 0.7 percent of the market, though browsers based on Opera are used on a number of “smartphones” and video game consoles because of the browser’s small footprint. Many other niche browsers, some free, some pay, have an even smaller market share among desktop and laptop computer users.

Microsoft isn’t the only aggressive player here. In March 2008, Apple generated criticism and controversy by including the latest version of Safari (www.apple.com/safari), the first non-test version for Windows, as part of its automatic update routine for users of Apple’s popular iTunes digital media player and Quicktime web video and audio player. Many Windows users, according to anecdotal and media reports, downloaded and installed the browser thinking they needed it to run iTunes or Quicktime.

Using More Than One. As long as you have the hard disk space, and most people have plenty to spare, no harm will come from having more than one browser installed on your PC. In fact, testing out different browsers can be a fun and useful activity. But Apple, though not trying to thwart competition, was being a bit too tricky with its tactics in trying to gain market share among Windows users.

Companies have been fighting so fiercely to get you to use their free browsers for a number of reasons. In the past, web search companies paid serious money to be a browser’s default search tool, and other companies with a web presence paid to be listed in the default set of bookmarks that came with the browser. In the future, most computing may be done not with desktop programs such as those included in Microsoft Office but web programs, with the browser being the gateway and with huge online advertising revenues at stake.

Since the pre-Mosaic days, I’ve tested many browsers and use Firefox most today, appreciating its breadth of features and security. Safari, however, renders pages quickly, has an innovative text search tool that highlights all occurrences on a web page of the text you’re searching for, and is worth checking out in particular if you use a PC at work and a Mac at home.

If you’re the intrepid sort, kicking the tires of the beta, or test, version of the next version of the browser you’re currently using can be enjoyable as well. Such testing is designed in part to help the program’s developers discover bugs and improve the product before the final release.

Reid Goldsborough is a syndicated columnist and author of the book Straight Talk About the Information Superhighway.
STUDENTS watch intently as a mechanical creature struggles up a steep slope carrying an almost impossibly heavy load. Within inches of the top, the mighty juggernaut falters and begins to slide backwards—legs scrambling, it teeters on the brink of collapse. With the creature’s creator gathers the pieces of the fallen beast and leaves to revive and repair it for another attempt at the hill.

What has just been observed is not uncommon during the time students spend completing the Hill-Climb project during their enrollment in the second level Computer-Aided Drafting and Design (CADD 2) class that I teach. This is a great activity for technology education students.

Getting Started

This activity began as an independent study project for an advanced student working in my entry-level CADD class several years ago, before my school offered CADD 2. We obtained several incomplete sets of LEGO blocks from the middle school technology lab, combining them to create two complete sets for students to work with. Each set contained a variety of LEGO blocks and, very importantly, a 9 V motor and battery pack.

I soon realized that using batteries to power all of the class’s projects would prove very costly. To eliminate the need for batteries, I found a standard lab power supply that wasn’t being used in one of our science labs. The science teacher was gracious enough to let me borrow it when working with this project. The power supply allows a constant voltage and amperage to the LEGO motor. It plugs into a standard wall receptacle. The power supply also allows each student to have exactly the same power source available and eliminates the variable level of power that batteries supply over their lifetime.

At first, the two LEGO sets worked fine, but it was clear that to make a project work for an entire class, I would need more, so I applied for a grant offered by our Owen J. Roberts Education Foundation.

With grant money, I purchased eight motorized sets from the LEGO Education web site (Photo 1). The grant helped to spread out the cost of the equipment and minimize the impact on the Technology Education department’s budget. I highly recommend checking to see what kinds of grants are available for special equipment purchases.

A large portion of this project relies on the availability of computer-aided drafting software. My students currently work with AutoCAD LT 2000, but you can use just about any version of AutoCAD or similar drafting software for the project. Ideally, each student should have access to a computer workstation with the drafting software loaded.

Planning and Construction

The goal of the project is reasonably straightforward: students will design and construct a vehicle capable of transporting a 500 gram weight up as steep a slope as possible. They must construct the vehicle entirely of...
LEGO blocks from the provided set.

The vehicle must make its way up the incline without any student contact or interference once the student has switched it on.

I start the activity with several days of hands-on instruction and lectures on topics that include torque, traction, gear ratios, and various types of locomotion. After a few days of these introductory lessons and activities, students start to design and construct their own hill-climb vehicle. The activity packets included with the LEGO sets are great for students who are unfamiliar with the various ways LEGO blocks can be arranged and combined.

As students begin to develop their vehicle, their design usually revolves around one of three different forms of locomotion: wheels, tracks, or legs. When working with wheels, the student must decide if the vehicle will be front-wheel, rear-wheel, or all-wheel drive. Each system has advantages and disadvantages that students need to explore during design, construction, and testing.

Most students choose to work with wheels or tracks, but occasionally one tackles the difficult task of working with legs or similar devices. And some students have taken truly unique approaches that use none of the forms mentioned above. Can you think of an original design without the use of legs, wheels, or tracks?

Students usually encounter several problems during the design and construction portion of the project. The first obstacle is the lack of torque produced by the standard 9 V LEGO motor. To move any type of vehicle, students must first design and construct a system of gears and/or pulleys to reduce the speed of the motor and create a significant amount of torque.

At first, many students view this as an impossible task, but they quickly realize that the small LEGO motor can pack a serious punch. It is not uncommon for students to develop gear trains that create so much torque that the belts break, gears strip teeth, chains unhook, and plastic drive shafts twist and sometimes break under the stresses created. I have witnessed a plastic LEGO worm gear being driven laterally through another LEGO block while the motor hummed away, showing no signs of stopping. While working with these gearing arrangements, students see firsthand the relationships between motor speed and torque.

As students develop their designs, they may test their vehicles on the testing incline (Photo 2). I developed an incline constructed of 3/4" plywood, a pair of door hinges, roofing rubber, and a length of wood dowel rod with a shaft collar (Fig. 1). The shaft collar allows for adjusting the incline angle. Students can keep testing their design until they are satisfied that they cannot further improve it. At this point, the student records the angle for use later in the project. With the design and testing portion of the project completed, students move to the computer.

**Drafting and Design**

Now, students create a set of instructions detailing how their vehicle is constructed. To begin this process, they need to create an isometric drawing of each piece used in the project. Part of the beauty of the project is that when working with a set of building blocks, the pieces are based on uniform dimensions. This means that after students have created one or two blocks, they can create the rest of the drawings relatively easily. Students create the step-by-step instructions for their project by rebuilding the vehicle a few pieces...
at a time and drawing the pieces as they come together (Photo 3). Students have used digital cameras and camera phones during this part of the project to record each step as a reference for their drawings. I have found this a great way to stretch supplies in the lab. We discuss the use of these other tools in class to demonstrate how technology can help students achieve their goals. By using the digital pictures as a reference, the student doesn’t need the set of parts in front of him or her, which frees up the set and thus allows someone else to work with it. The final product for this part of the project is a complete set of step-by-step instructions that can be followed by other members of the class. This packet plays a key role in the final portion of the assignment.

**The Final Test**

At this point in the project, students have been working for several weeks designing, building, testing, and drawing their own vehicles. The final part involves turning over all their work to someone else for one final test. I collect the completed assembly drawings from each person in class and then pass them back out randomly. (Needless to say, it is essential that students don’t receive their own instruction packets.)

Now, everyone builds the vehicle that they have received instructions for to the exact specifications laid out in the drawings they received (Photo 4). Once construction is completed, the vehicle is again tested on the testing incline. Hopefully, the vehicle can climb up the same slope it was originally tested on, which is then confirmed by talking to the designer and looking back at the notes taken earlier in the project.

**Modifications**

You can adapt this activity to run in many different labs. I have it in my drafting class, but it could easily find a place in a transportation, manufacturing, or materials lab environment. In drafting, the project’s emphasis goes to the individual part drawings and the steps needed to create a final assembly drawing. You can shift the focus to the vehicle’s design and operation if you teach transportation or introduction to technology.

Slight modifications to the design problem can also lead to greater flexibility and creative solutions. On occasion, I require that independent study students complete the project without using wheels or tracks. I’ve also run the project telling the student that they may not use gears and must instead rely on pulleys and belts. In a materials or transportation lab, the testing incline can be designed to accommodate different surfaces, such as sandpaper, plastic, carpet, or wood to test how traction changes on different surfaces.

While I designed the project as an individual activity, you could easily modify it to work well in small groups or as a class competition. When working in small groups, another option would be to combine several sets of blocks and create a much more complicated vehicle.

**Final Thoughts**

This project began with the need to address several specific state standards in a nontraditional lab environment, but it has quickly grown to encompass much more (PA Science and Technology Standards, 2000). Students enjoy the activity and news has spread about it and the class. Students outside my classes have stopped to see the activity in progress and come back to talk to me about the course. The interest created has helped promote technology education in general, along with my own particular program.

I primarily designed the activity to increase student understanding of the assembly drawing process and its components. The emphasis on problem solving adds a dimension that can aid students in their other classes as well.

By working within the constraints of the design brief, students are always seeking creative and unique ways to reach their goals. The activity also benefits students in requiring them to assess and solve problems scientifically at a higher level as described in Bloom’s Taxonomy (Bloom, 1956). After learning the basic terminology and concepts behind the project, students quickly move into situations involving application and analysis. As the project develops, they work with synthesis and evaluation activities. This project allows students to work at these higher levels of learning and be challenged without feeling overwhelmed.

**References**


INVENTION is a natural part of the human condition. It does not exist outside our everyday activities, and it certainly does not come like a bolt out of the blue. As Edison said, it is “99 percent perspiration and 1 percent inspiration.” The prepared mind, as always, is favored for success. Setting the stage for invention is as important as carrying it out. Good corporate leaders know this—as does any astute technology education teacher. This article will provide some ideas, inspired by activities from my childhood, for fostering inventiveness in your technology students.

Real-world problem solving delivers the high-value goods in the classroom. Unstructured problem solving, a little trial and error, and flying by the seat of one’s pants seems to burn lessons into a young mind so much more effectively than reading about it. (This is where technology education has it over the other subjects—heads and hands work together to create powerful learning paradigms that far outlast the rote memorization and testing associated with day-after-day, stultifying, “chalk and talk” recitation.)

In this article I’ll take a walk down memory lane to my old neighborhood in Newark, NJ, to revisit several home-grown street technologies the kids of Second Avenue conjured up to deal with what we thought to be real problems. (Incentive to solve a problem, you will soon see, is in the eye of the beholder.)

I hope you’ll find food for thought here, along with ideas for classroom challenges. You might want to share my tales of invention with your students, then get them working on inventive solutions to some contemporary problems.

Now, let’s climb onboard the time machine, for a trip back to a few neighborhood technology activities from the 1950s...
get the ball. This approach had two major disadvantages: The little fellow usually was too busy screaming to focus on getting the ball, or the sewer opening at the curb was too small to allow for stuffing the wriggling human mass through it. Having seen this method in action once, the little guys would run for home as soon as a ball went down the sewer. Clearly, we needed another, more sophisticated, approach.

Our solution used common materials on hand: a soda can, a coat hanger, string, and a few rocks. Figure 1 shows the design of our ball retriever. The key is to allow the can to sink once it hits the storm sewer water—which is where holes punched in the bottom of the can and rocks come in. The can only has to sink below the surface about an inch. The coat hanger is shaped to allow plenty of open area so that the can, when maneuvered properly (Fig. 2), will come to rest just under the floating ball. As this positioning is accomplished, a young fellow gently tugs the string upward, bringing ball and can together. Water drains out through the holes, and ball extraction is achieved.

Figure 3 puts this entire operation into perspective with a side view of the problem, the technology, and the process. In many cases, the ball did not float so near the curb opening to the sewer. In such a situation, a “stick man” was employed to slide a thin piece of wood, like a 1 × 2 furring strip, down the sewer grate and gently nudge the ball toward the can, where it could then be retrieved. Much of the action occurred close to the curb area, often requiring two hands, one to “jimmy” the string and one to reach down and around under the grate to grab the ball. Often two to three kids were involved. Laying face down on the sewer grate was quite common during the retrieval process.

Certainly, we are unlikely to find such problem sets existing today. The need for 1950s-era wizardry has likely joined the ash-heap of outdated technology, but this story does demonstrate that kids can solve problems when the conditions are right, learning from each other. Back
then, the incentive for invention was great—the continuation of the ball game. Today, some enterprising student might employ his father’s extendable golf-ball retriever to accomplish the extraction, or simply buy another ball. We were victims of the times and thus our invention reflects the social conditions current then.

I remember the above inventive activity well, since I was the official Second Avenue keeper of the can and chief ball retriever.

Bottle Cap Launchers
During frequent games of army, we wanted all the action we could get. For a while, bean shooters sufficed as arms for the necessary duels of honor with kids from neighboring streets. After filling the streets with spent beans and unofficial sniping at younger brothers and sisters, bean shooters grew boring. We needed technological advancement, something to slake our thirst for ever-increasing levels of action. And thus was born the bottle-cap launcher.

We began by seeing how far we could hurl bottle caps, which had a natural tendency, because of their shape, to float and curve like today’s Frisbee. (Maybe flying bottle caps were the early prototype idea for Frisbees. Who knows if this analogy was pursued?) Anyway, someone in our neighborhood had the bright idea of firing bottle caps as a sort of ammunition. Certainly that form of ammunition was aplenty. Bottle caps were everywhere and easy to amass into a cache of ammo. But how could one launch them? Were we to simply throw them at one another?

All you really need for a bottle cap launcher are some elastic bands, a flat board, like a 1 x 3, and an old spring-type clothespin. It’s a low-cost recipe for fun, and you can make the launchers in different sizes.

Most preferred a 3’ model. More aggressive types liked the quick-draw action of a 2’ model. And some desperate types liked the short, 1’ heavy-duty, rubber band, high velocity, sawed-off-shotgun approach to neighborhood quarrel settling. Up close and personal, a bottle cap to the guts determining the winner.

Figure 4 illustrates the working mechanism of a 1958, Mark II, 0.80 caliber, North Newark bottle cap launcher—generally accurate in light winds to about 50’. The elastic bands do all the work, both launching the bottle cap and holding the clothespin trigger down. It’s an exquisite model of tension in balance, until an itchy trigger finger sets it all in motion.

In practice, we found a company of long-range bottle cap riflemen, combined with a squad of rapid-fire machine-gun bean shooters posted at the flanks, to be the most effective fighting formation for the Second Avenue Regulars. Our turf was well protected.

Additional Inventions
We invented other things for fun, as well. For example:

● Pinball machines made from sections of wood planks using nails.
and elastic bands for bumpers. Marbles served as pinballs, and pockets for scoring points consisted of clusters of nails woven with rubber bands. You flicked the marble up a sectioned-off railway with your finger, and action began. Who needed electricity?

● Ever open a fire hydrant with just a coat hanger and piece of wood about 18" long? A really hot summer will yield an invention like that. I was most proud of that one, having been the chief designer—until the police and fire captain gave us a stern warning. Afterwards I heard the captain laugh to his truck crew and say, “Did you ever see anything like that?” We thought we’d put one over on the grown-ups that day—until our fathers came home from work!

● We made a nine-hole golf course too, complete with hazards and homemade wooden clubs. It’s amazing what you can do with empty lots. Of course, we used rubber balls instead of regulation golf balls.

My buddy and I learned a great lesson about protecting the rights to your inventions in the summer of 1961. We invented a new kind of board game, wrote up the instructions, and sent it off to a game company (which shall remain nameless). It was promptly rejected as too complicated. About eight years later, a modified version of the game appeared on the market! We were flabbergasted! But the game bombed, which gave us some measure of satisfaction. You can be sure I have since that time made sure to protect my inventions with patents and other techniques. I still have the original game my buddy and I made.

Youthful Invention Today

Do kids solve problems like this today? Do they invent things to satisfy their cravings for fun? Are the conditions right for them to want to do so? Perhaps your classroom can provide a conducive environment, a creative space for examining unstructured problems and exploring solutions.

● Have your students invent games for the classroom or for a school playground.

● Have them invent games for a school-wide fair where money is raised for the school or charity.

● You might identify a real problem like car theft and ask students to develop anti-theft devices that can thwart would-be thieves.

● Have them develop devices to keep children from being separated from their parents and kidnapped.

● How about designing robots that can aid a wheelchair-bound adult? I have done this and been utterly amazed at what students came up with.

Surely some nagging problems around your school are begging for solutions. Strut your tech ed stuff and make a difference. Show how technology can be a strong force for social good. Get some student teams on the job.

But always remember to set the environment properly. Place the problem in context and importance. Let the students come to own the problem. Lead them. Do so, and something magical might happen in your classroom.
Our “School Web Site of the Month” feature has turned out to be very popular with Tech Directions readers. Information on the featured sites provide useful information and, according to some, “inspiration.”

To get the school year off to a good—and perhaps inspiring—start, we’re showcasing in the August issue the site produced by Bradley H. Schuster (bschuster@magnoliaisd.org) and his students at Magnolia High School, Magnolia, TX, http://magnoliaisdcommunities.org/communities/bschuster. Schuster teaches architectural drafting and building trades classes at both Magnolia High School and Magnolia West High School.

Creating a New and Improved Site

Schuster came up with the concept of his current web site as a result of a class on blogs and web sites hosted by the Magnolia Technology Department. He’d had a site prior to that class, but credits a new, easier-to-use system provided by the technology department with inspiring creation of the new site during the 2006-2007 school year. He wanted with the new site both to give students information about his course offerings and to provide a vehicle for displaying his students’ work. He feels that it’s important to give students online access to examples of what they’ve learned and created and to give them input on site content. He has the sense that from this point on most people will display work on the Web—and that doing so will be important to developing their careers. “The need for my students to utilize this resource for work and career enhancement will be vital in the future,” he said.

Some parts of the site that Schuster himself maintains feature detailed descriptions of course content and goals for every class he teaches. This gives both students and parents a good sense of what the courses are about before students enroll. Schuster also provides information on his students’ winning efforts in state and national competitions.

Generating Content

Most site content is developed by Schuster’s students using programming available in the computer lab while working on class assignments. “I put homework and assignments on the web site under each class heading for both students’ and parents’ reference,” he says. Most photos on the site are shot by Schuster and his students, with illustration from outside sources used when appropriate.

Schuster and his students try to update the site weekly, though it sometimes takes two or three weeks to update his class assignments. Advanced classes do updates on Monday, and most times they can update only one to three students’ work in one period, so it takes 6 to 7 weeks to get all advanced students’ work updated. While obstacles that cause delay sometimes arise, Schuster does try to update his portions of the site every week.

Addressing Problems

When asked what problem-solving
strategies he uses in designing and maintaining the site, Schuster noted that programming and memory space has caused a “try, ask, try again” approach to what can be done on the site. “The students and I usually come up with an idea, and we then try to attach, amend, or reload the items we want to put on the site. If that doesn’t work we call our technical support people, Thomas Weathers, Melissa Beaird, and Chris Turek, to see if something can be done to accomplish our design.” Sometimes Schuster acts as the relay between his students and the technical support staff to fix problems with programming and site content.

Tech Directions asked Schuster about his background in web work and he responded, “Every now and again over the last 20 years I have taken classes in the military, private sector, and education fields to develop web sites. In most cases I designed or assisted in the development of sites pertaining to my areas of expertise. The technology has gotten easier to use over time, which now allows me and my students to utilize this resource.”

More on Student Involvement

At least 20 of Schuster’s students were involved directly in design and maintenance of the web site during the 2007-2008 school year. Schuster encourages all his students to critique the site and make suggestions for additions and improvements. Schuster and his students work with the web site both in class and after school. Students in his advanced classes are required to put examples of their work on the site.

Reflecting on how his students benefit from the web site, Schuster said, “Since the web site can be seen by anyone, it puts the student in the position of wanting to do their best work. Students can also compare their work to others on the Web. It’s a great tool for showing strengths and weaknesses and it allows my students to get help on things that they may be weak on or that they want to try from other students’ design.”

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AST year’s Tech Directions Inventors Award competition drew a great response—even more than the previous year’s and we received a number of excellent entries. And now we’re back with a new challenge for the 2008–2009 school year!

In recent months, famed inventor Phineas Quirkbotham has noticed that his nephew Thaddeus P. Quirkbotham is really quite good at technological innovation. This, needless to say, is a great source of pride. When Thaddeus asked his uncle for a design challenge with which to further sharpen his creative skills, Phineas proposed that he devise a new use for discarded cardboard milk cartons.

Phineas has observed that Thaddeus is now at work on generating a truly “boffo” new application for these simple, free common household items—and he challenges your students to outdo him. So, have your students don their thinking caps, crank up their creative juices, and see if they can be as inventive as nephew Thaddeus.

If Quirkbotham and inventor/engineer/assistant judge Harry T. Roman think your students’ ideas are among the best, they will receive a Tech Directions Inventors Award certificate and their solutions will be published in the magazine. The top three competitors will also receive a book or poster of their choice from Tech Directions Books & Media. All winners will have a notable accomplishment to list on future resumes and college applications, and your technology education program will receive some excellent publicity!

Here are competition guidelines:
- Students should provide a written description of their suggested uses for the milk cartons. They should use drawings to help explain their ideas or illustrate any necessary modifications. All drawings should be either computer generated or hand-drawn in ink. Please use only one side of the paper and use only plain paper—no graph paper, since it will not reproduce well in the magazine.
- On a second sheet of paper, describe why the milk carton invention is important and how it is used. What is it about the invention that improves people’s lives?
- Submit ideas by January 30, 2009.

Mail all invention submissions to: Inventors Competition Tech Directions PO Box 8623 Ann Arbor MI 48107-8623

Note that the judges suggest that each student brainstorm many ideas, but select just the single best idea to submit to the competition. This approach allows for really focusing attention and effort on the best idea. The judges also encourage students to let ideas flow freely and not be afraid to unleash their imaginations.

We hope you’ll encourage your students to take the Great Milk Carton Inventors Challenge—and we wish them the best of luck!
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More than Fun Answers

Tech Rhymes
1-D Awl-Pawl 4-C Nail-Pail
2-A Cell-Bell 5-B Plane-Chain
3-E Clamp-Lamp

Sudoku Mania

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5 4 3 9 7 2 8 1 6
9 2 8 6 1 3 7 4 5
1 7 6 8 5 4 9 2 3
7 3 5 1 2 9 4 8 6
4 6 1 5 3 8 2 9 7
2 8 9 7 4 6 5 3 1
6 1 4 2 8 3 5 3 9
8 9 2 3 6 5 1 7 4
3 5 7 4 9 1 6 8 2
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more than fun

Tech Rhymes
The devices shown in the drawings (1-5) and (A-E) have nothing in common except that their names rhyme. See if you can find the rhyming pairs.—Submitted by Robert Balin, Cypress, CA.

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Sudoku Mania
Complete the grid such that every row, every column, and the nine 3 x 3 blocks each contain the digits from 1 to 9. No mathematics is required, just plain old logic.

“I don't understand it, sir, the computers have only been down for an hour.”

We will pay $25 for brainteasers, one-period challenges, and puzzles; $20 for cartoons; and $5 for jokes and humorous anecdotes used on this page. Preferable theme for all submissions is applied science, technology, and technical education. Send contributions to “More Than Fun,” PO Box 8623, Ann Arbor, MI 48107-8623.

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See answers on page 29.
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