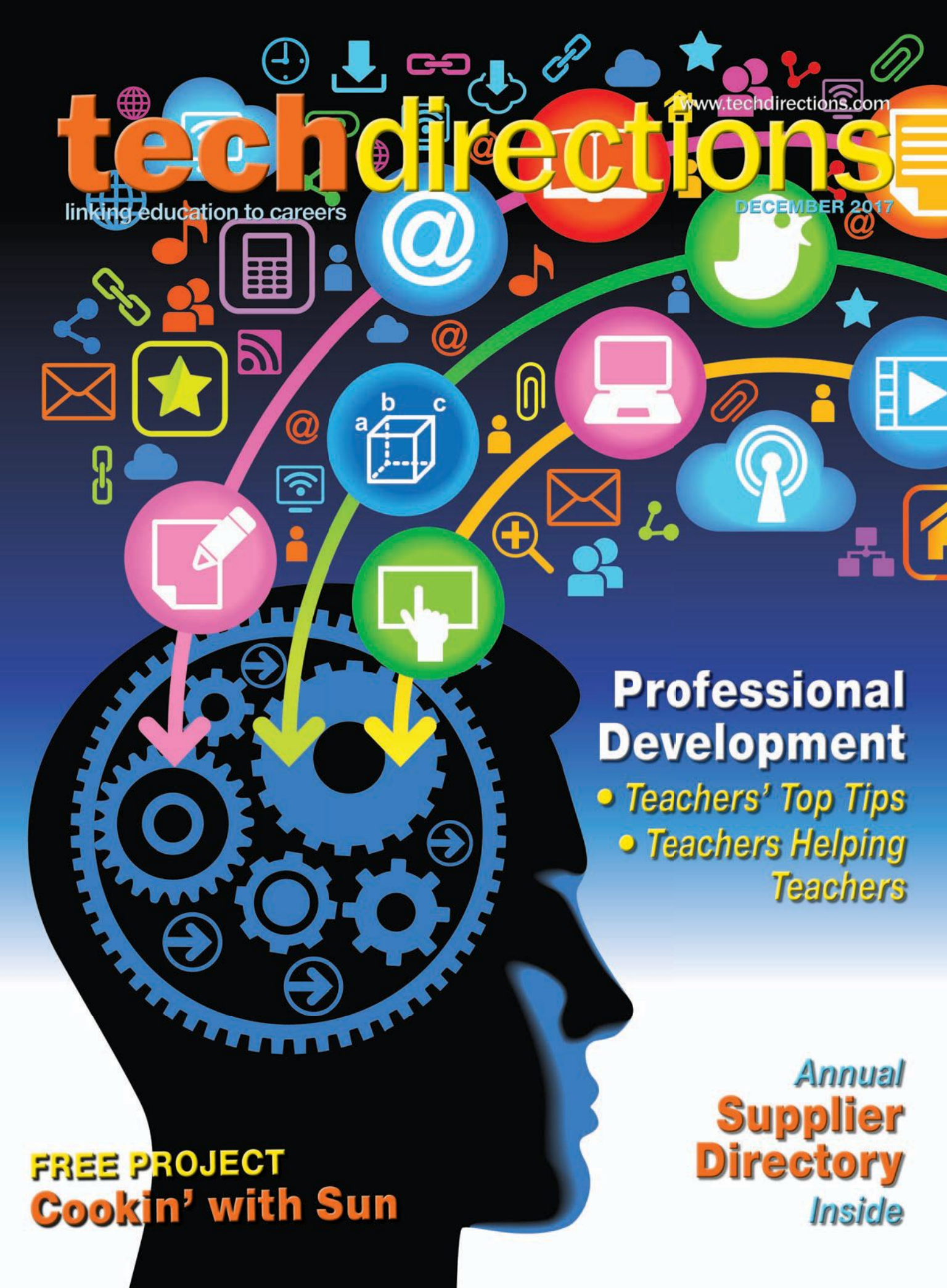
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technically speaking

Vanessa Revelli vanessa@techdirections.com

We all know about the skills gap. We talk about it all the time, and try to figure out how we are going to solve it. How are we going to get kids interested in the skilled trades? How we are going to change the negative public image that the skilled trades still have?

The Construction Advancement Foundation and Northwest Indiana Workforce Board tried something very interesting this year to try to tackle some of these issues. They held a career fair to show high school students how to get work in the skilled trades. Present were over fourteen different union trade groups who taught about 1,000 students from numerous high schools in the area. The students got hands-on demonstrations of what the work is like, including laying brick with trowels, drilling holes in walls, making insulation, operating survey equipment, and hauling loads with virtual cranes. They also learned about apprenticeship programs that can lead to high-paying jobs and took apprenticeship applications home with them for programs that sounded interesting.

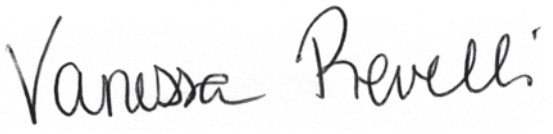
"They wanted a way to bring awareness to the trades, and the skills required and the openings that are occurring in each of the trades," said Sandy Alvarez, a senior associate at the Northwest Indiana Workforce Board. "We have parents that brought their kids, that took them out of school so they could be here today. They haven't done anything like this in 10 years."

"To be able to get all these trades under one roof, that was no easy task," said Barb Grimsgard, of the Northwest Indiana Workforce Board. "There's a lot of activity at each booth. They're trying to engage the kids as much as possible." Increasingly, schools are realizing not every child should be pushed into a four-year college, Grimsgard said. "There are other options for them—good-paying, stable jobs with good benefits," she said. "Parents are slowly coming to the realization there are other options if their children don't want to go to a four-year college."

"You can tell they [the kids] are enjoying themselves," said Kevin Comerford, the Construction Advancement Foundation's director of professional development. "They're engaged. They're meeting with apprentices, who aren't that far removed from high school and who they can relate to because of the age. There's a lot of good questions being asked by the students."

The unions are concerned with the so-called "silver tsunami"—an aging membership that's expected to result in a wave of retirements in the coming years. They are hoping to get young people interested to follow the skilled trades path.

"I keep hearing the quality of applicants is not very good," Comerford said. "They'll get a handful of good ones and the rest are mediocre. We try to get the best candidates we can. We're trying to educate high schools that these are viable careers that exist, that they pay very well. The average wage is over $60 an hour, when you include benefits."



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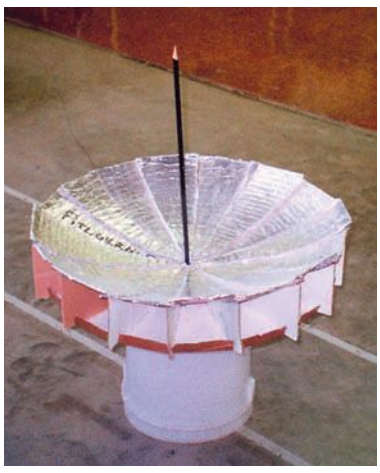

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COLUMNS

About the cover: Using a variety of technologies allows educators to connect to other educators, students, and parents, and can facilitate professional growth and development. Cover design by Sharon K. Miller.

the news report

Vanessa Revelli
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New Flipped Learning Trainer Certification Program

The Flipped Learning Global Initiative, (FLGI), was created to support the rapidly expanding adoption of flipped learning all over the world. FLGI aims to fill the growing global need for collaboration across borders in three domains: evolving best practices in Flipped Learning, research curation and distribution, and technology selection and implementation.

Flipped Learning can best be explained by the four pillars: 1. Flexible Environment. Educators create flexible spaces where students choose when and where they learn. Additionally, educators who flip their classes are flexible in their expectations of student timelines for learning and in their assessments of student learning. 2. Learning Culture. In a Flipped Learning model, in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities. As a result, students are actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful. 3. Intentional Content. Educators determine what they need to teach and what materials students should handle on their own. Educators use Intentional Content to maximize classroom time in order to adopt methods of student-centered, active learning strategies, depending on grade level and subject matter. 4. Professional Educator. During class time, they need to observe students, providing them with instant feedback and an assessment of their work. While Professional Educators take on less visibly prominent roles in a flipped classroom, they remain the essential part that enables Flipped Learning to occur successfully.

This past June, the FLGI announced the Flipped Learning Level – I Trainer Certification program. The new "train-the-trainer" course and certification program was developed to give support to the myriad flipped classroom training programs currently delivered in countries around the world. The aim is to ensure that Flipped Learning trainers around the world have access to the most current global research, global best practices, and proven technology.

"The train-the-trainer program is the first of its kind. It combines the latest Flipped Learning 3.0 insights, with best practices gleaned from over a decade of delivering flipped

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Vanessa Revelli is managing editor of **techdirections**.

training workshops in various subjects, academic levels, countries, and languages around the world," said Jon Bergmann, Flipped Learning pioneer and chief academic officer for the FLGI. "Our goal is to nurture world-class Flipped Learning trainers, and we are excited about this first step."

This program is for teachers who have been promoted to Flipped Learning trainers or instructional coaches. The program is also for those who want to start sharing Flipped Learning with peers in a more structured format. This course is for those who have already been conducting training in Flipped Learning and want to update their skills with the latest Flipped Learning 3.0 insights and global best practices. Finally, the program is for highly experienced Flipped Learning trainers who want to validate their skills with the International Flipped Learning Certification.

The beta version has been launched and is currently available to the public for preview at http://flglobal.org/trainercertification/

Seeed Studio Helps All Teachers Teach STEM Education

Seeed Studio announced its new Grove Zero STEM Starter Kit, which is a set of color-coded and magnetic electronic modules that teaches students about programming, electronics, design thinking, and logics. The Grove Zero modules are designed for STEM education and allow teachers with no experience or lots of experience to bring the detailed lesson plans into their classroom and embed them in their learning system.

"Our Grove system helps makers around the world build prototypes with development boards easily and quickly. However, writing code and connecting wires sometimes can be really difficult for early beginners, especially younger kids," said Chao Zhang, the product manager of Grove system at Seeed Studio.

To solve this problem Chao and his team have placed an MCU on each of the Grove Zero modules—they come preconfigured with set code which allows kids to just simply snap the modules together and get started. The modules can be reprogrammed as well with a graphical approach, with options being either Microsoft MakeCode, or Seeed Studio's Module Matcher. To reduce the need of wires even further than their Grove connectors Seeed Studio has created versatile magnetic adaptors which let them snap the modules together in any way they want. These features make Grove Zero a great educational platform for all ages.

For additional support, SEEED provides almost 10 hours of open educational resources along with the kit. This helps teachers bring the detailed lesson plans into their classroom.

The Grove Zero kit includes one main board, five sensors, two actuators, and a power board and start at $99.50. For more information about the Grove Zero visit https://www.seeedstudio.com/edu/grove-zero.html.

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The Aerospike Engine

It is important for our students to realize that many technological breakthroughs only come after repeated laboratory or prototype failures. As teachers we all know this, but many of our students are too quick to give up when a project they are working on first doesn't go as planned. In this column I selected an emerging technology that aeronautics engineers have been struggling to bring to fruition for many years.

Seventeen years ago NASA released a fact sheet about a new type of rocket engine they were trying to develop with Lockheed Martin. This engine could eliminate the need to use booster rockets to launch satellites and people into space. NASA's aerospike engine, which they described in August 2000, was actually an engine concept first proposed in the 1960s by Rocketdyne, then a Boeing division.

Aeronautical engineers have now spent at least 67 years trying to perfect this technology. The engine is finally ready for its first test launch early next year.

Actually, some early NASA designs of the space shuttle showed an exhaust flume that would have been created by an aerospike engine, but I could not find any NASA records that showed they proceeded past ground testing before their plans to use an aerospike on the Space Shuttle were shelved. You can read NASA's original document on this engine online at https://www.nasa.gov/centers/marshall/news/background/facts/aerospike.html

It looks like ARCA Space Corp. (arcaspace.com/en/news.htm) has finally carried this rocket concept to the finish line. Sounds kind of simple as I write it, but all that is left for them to do is complete ground testing of the engine shown on the stand (Photo 1); move their test rocket (shown on a flat bed truck in Photo 2) to the launch pad; do all the pre-flight checks, and finally launch the Haas 2CA, the world's first SSTO (Single Stage To Orbit) rocket, into space.

The ARCA Space Corp. artistic rendering (Photo 3) shows an exhaust-shaped nozzle that looks nothing like what we are used to seeing on a rocket launched into space. Instead of confining the exhaust gases by a conventional bell-shaped nozzle, an aerospike uses the changing air pressure of our atmosphere, from the ground to space, to partially control the shape of the expanding gases that push the rocket forward.

Today the different stages of a rocket have different shaped bell nozzles to help them get the most forward push through the atmosphere that they are going through. The bell-shaped nozzle designed

Photos courtesy ARCA Space Corp.

Photo 1—The aerospike demonstrator test engine on the test stand. Within the next few months it should be cleared for a test flight.

Photo 2—The rocket on the flat bed has the aerospike engine on board, ready to be taken to the launch site. If all goes as planned, it will perform a suborbital space flight. Its sea level thrust will be 4.2 tons from a low-energy propellant. It can reach space because the aerospike engine design lets its nozzle conform to be most efficient for the atmospheric pressure it is flying through.

Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.

for the first stage grows significantly less efficient as the rocket climbs toward outer space, so the higher it goes the less pushing force you get from the fuel that you are burning. This happens with each stage until finally the rocket enters orbit. With a conventional system, each consecutive stage has a bell-shaped nozzle most effective for the air pressure that it will encounter once it is ignited, to further push the rocket away from our planet.

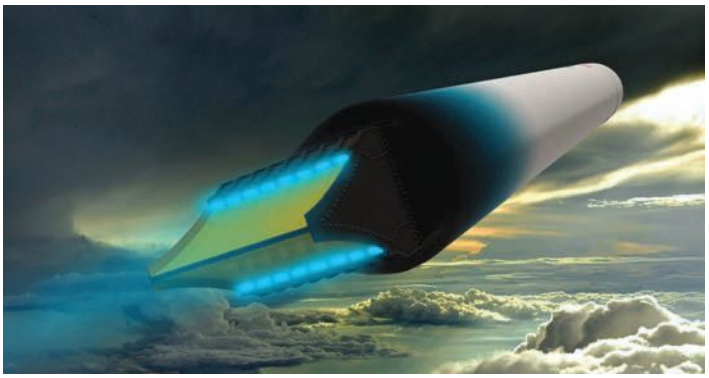

Photo 3—Artistic rendering of how different an aerospike engine nozzle is from the bell-shaped nozzle found on all past rockets.

This NASA quote best describes why ARCA's aerospike engine could significantly change, and speed up, our ventures to other planets: "The initial stage of the Saturn rocket which carried the Apollo astronauts to the moon featured a narrow nozzle to produce an ideal straight-edged column of exhaust at sea level. However, the command module which orbited the moon featured a much wider bell nozzle better suited for controlling the combustion gasses in the vacuum of space."

NASA's point was, if an aerospike engine could be successfully developed, it would be an SSTO rocket engine that could perform at sea level just as efficiently as it could perform in space on a trip to the moon or Mars. This video (youtube.com/watch?v=EWf4iOMSPNc) shows a test firing of an aerospike engine. It also uses animation to show how an aerospike engine works, and why its nozzle design could get the best propulsion at sea level or even in the vacuum of outer space.

Taking It a Step Further

1. With the power of the internet at your fingertips it is not difficult to research the history of most technological developments. Select 5 technologies that interest you and document how long it took to develop them.

2. Most technology labs include a rocket building activity. When you test fire the rocket project that you build, is the efficiency of its rocket engine affected by a change in air pressure during its flight? Why? td

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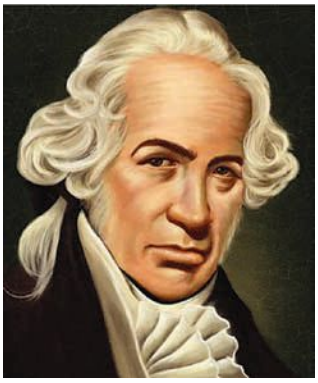
Gabriel Fahrenheit and Anders Celsius and Their Temperature Scales

Few conversions between the American and metric systems of measurements are more confusing than temperature readings. Part of the reason is that each starts with a different value for the freezing point of water—32° on America's Fahrenheit scale and 0° on the metric Celsius scale. Gabriel Fahrenheit from Poland made the first reliable thermometer in 1714. Anders Celsius was an 18th-century Swedish astronomer who gave his name to the metric scale in 1948.



Gabriel Fahrenheit

Anders Celsius

Fahrenheit was born in Gdansk in 1686 into a family whose father was a successful merchant. The oldest of five children, his early schooling ended when his father and mother both died from food poisoning. Fahrenheit was sent to Amsterdam, the Netherlands, in 1701 as a business apprentice to follow his father's profession. He completed the required four years while spending his free time studying physics, particularly the area of measurements. He settled in The Hague, the Netherlands, where he became a glass blower and made instruments like thermometers, barometers, and hydrometers.

Left, an original signed Fahrenheit thermometer

Tube-type thermometers of the era resembled modern devices and usually used alcohol or mercury as the indicating fluid. Alcohol provided unreliable readings and impure mercury coated the inside of the tube. Fahrenheit discovered a way to purify mercury and began making mercury thermometers in 1714.

At the time, there was no standard temperature measurement scale. The way Fahrenheit developed his scale is a bit involved. Briefly, Isaac Newton had suggested using a temperature scale based on 12. Fahrenheit felt his mercury was eight times purer and would later multiply those numbers together. He first mixed a small batch of ice, water, and salt in his lab and inserted his thermometer. He called that reading 0°. He then measured his body temperature and called that reading 96° (12 times 8). Fahrenheit made some minor adjustments and that is why body temperature is now 98.6°.

His thermometers were the world's first accurate temperature-measuring instruments. Fahrenheit personally made many of them before his death in 1736.

Only three thermometers are known to exist that were actually made by Fahrenheit. Two are in the Boerhaave Museum in the Netherlands. The third one from a private owner sold at auction in 2012 for over $107,000. Its top temperature was marked as 132°.

Anders Celsius was born in Uppsala, Sweden, in 1701. He was the son of an astronomy professor and the grandson of a mathematician. He earned a degree from Uppsala University and became secretary of the school's scientific society in 1723. Celsius received a promotion to professor of astronomy in 1730 and began traveling throughout Europe visiting astronomers and observatories. He evaluated the northern lights (aurora borealis) and published an early documentation of the effect.

The French Academy of Sciences invited him to participate in an expedition to measure global latitude near the north pole. Their measurements confirmed Isaac Newton's theory that the earth is somewhat flattened at the poles. The scientific

Celsius's earliest thermometer, on display at the Uppsala University Museum

paper that Celsius wrote earned him a worldwide reputation.

The Swedish government funded his design for construction of the Uppsala Astronomical Observatory in 1741. It was equipped with instruments he purchased during his travels, including Fahrenheit thermometers. Celsius wanted physical measurements to be standardized between 0 and 100. He recommended a temperature scale between those numbers and used it on the thermometers he had purchased.

Celsius died of tuberculosis in 1744 at the age of 42. The centigrade scale came into use a year later, with 0° the freezing point and 100° the boiling point of water. The General Conference on Weights and Measures renamed it the Celsius scale in 1948.

Celsius is a popular historical figure in Norway and Sweden. A portrait of him appears on the vertical stabilizer of a Norwegian Airlines 737 aircraft. td

Celsius's portrait on the fin of a Norwegian Airlines LN-NON737

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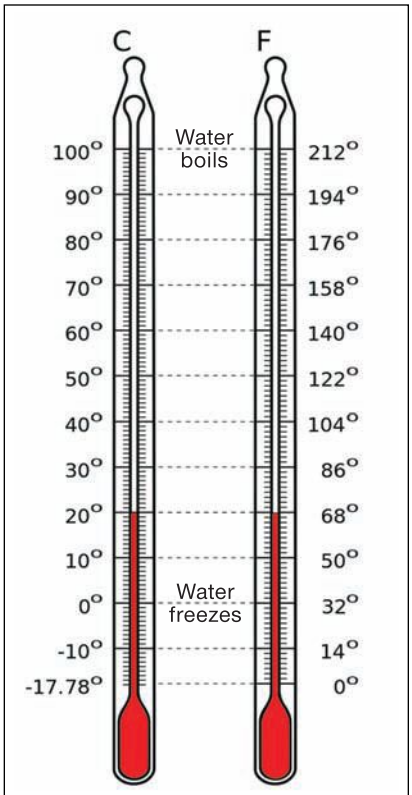

Comparison of Celsius (left) and Fahrenheit temperature scales

Reid Goldsborough
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Learning the Tricks of the PC Trade

Trick is one of those words that can have either a positive or negative connotation. You probably don't want to deceive, but you probably want to do things more efficiently.

Unless you're a hacker, computer tricks are in the positive category. There are lots of little, and sometimes not so little, tips and techniques out there that can shave a few seconds off frequently used procedures, or maybe even completely change how you work.

No compilation like this can possibly be comprehensive, but here are a few Windows tricks that might be worth doing if you're not already. If you're a Mac user, a good source of shortcuts is support.apple.com/en-us/HT201236.

Lock your computer—Windows-L locks it, requiring your password to resume, which can be handy if you don't want a coworker or roommate posting for you on Facebook.

Shut down—Program the Power button to shut down your PC. Press the Windows key and begin typing Power Options. Once there, select "Choose what the power buttons do," then for "When I press the power button" select "Shut down."

Launch a program—Pressing the Windows key is a quick way to launch programs. Begin typing the name of the program until it's displayed. An even quicker way is to create a keyboard shortcut. Find the program on the desktop or in the Start menu. Press the right mouse button, select Properties, click in the field after "Shortcut key," and press a keyboard shortcut such as Ctrl-Alt and the first letter of the program's name.

Move among programs—Alt-Tab moves you forward from one open program to another. Repeating reverses this. Holding down the Alt key as you repeatedly hit Tab shows you which programs are running and lets you move to the one you want to work with.

Close a program—Alt-F4 closes the program you're in. Ctrl-F4 or Ctrl-W closes just the tab or window you're in.

Go to the desktop—Windows-D hides all open programs and takes you to the desktop. Repeating reverses this.

Minimize or maximize the window—Windows-Down Arrow minimizes the window you're in, while Windows-Up Arrow maximizes it.

There are lots of little, and sometimes not so little, tips and techniques out there that can shave a few seconds off frequently used procedures, or maybe even completely change how you work.

Move or copy files—To move a file from one folder to another, open File Explorer (Windows-E) twice, creating two instances. In one File Explorer instance, select the file and drag it to the folder where you want it using the other instance. To copy it, hold down the Ctrl key while doing this. Or you can drag with the right mouse key and select copy.

Batch rename files—In File Explorer, select the files you want to rename, right click the first one, and type a name. File Explorer renames the rest with a 1, 2, and so on. To select all the files press Ctrl-A.

Save a document—This is the most basic trick of all. If you don't want to lose a document you're working on, save it periodically. The fastest way is Ctrl-S. If you're working off the cloud or on a smartphone, your files are automatically saved for you.

Delete a word—Within a document, Ctrl-Backspace deletes the entire word behind the cursor.

Move to the next word—Ctrl-Right Arrow moves one word ahead, while Ctrl-Left Arrow moves one word behind.

Undo a mistake—Ctrl-Z not only undoes your most recent typing, it can also bring a file back if you accidentally deleted it or moved it where you don't want it.

Paste without formatting—If you've copied text and don't want the original formatting, hit Ctrl-Shift-V instead of Ctrl-V. To select from a menu of paste options, hit Ctrl-Alt-V or press the right mouse button and look under Paste Options.

Insert a symbol—No matter what program you're in, you can access Character Map for symbols such as copyright and registered trademark by pressing the Windows key and beginning to type Character Map. Find the symbol you want, click it, and hit select to copy, return to your program, and paste it in using Ctrl-V.

Type in a site's address—From within your browser, F6, Ctrl-L, and Alt-D all take you to the address bar.

Navigate webpages—Hitting the spacebar scrolls down a full screen, while Shift-Space bar scrolls up. Your mouse's scroll wheel is excellent at taking you down or up in smaller increments.

Make text more readable—Ctrl-Plus magnifies the webpage you're on, while Ctrl-Minus reverses this. To reset a page to its original magnification, press Ctrl-Zero.

Move among browser windows—Ctrl-T opens up a new tab, Ctrl-Tab moves you forward among open windows, and Ctrl-Shift-Tab moves you backward.

Reid Goldsborough is a syndicated columnist and author of the book Straight Talk About the Information Superhighway.

The Global Search for Education:

Teachers' Top Tips for Designing Meaningful Professional Development Programs

By C. M. Rubin

IN a 21st-century world, where we are learning, unlearning, and relearning all the time, how can teachers keep up?

The presence of technology in schools is increasing as are the opportunities to integrate tech into practice. However, the moment teachers master one new piece of tech, there may be something newer they need to learn. Educators are living with the new tech challenges all over the world, so if they were calling the shots, how would they approach the development of meaningful professional development (PD) programs?

C. M. Rubin is author of two online series for which she received a 2011 Upton Sinclair award, "The Global Search for Education" and "How Will We Read?" She is also publisher of CMRubinWorld and a Disruptor Foundation Fellow. Condensed, with permission, from a July 26, 2017, post on educationviews/org. Read the post in its entirety at www.educationviews.org/global-search-education-teachers-top-tips-designing-meaningful-pd-programs.

The Global Teacher Bloggers are pioneers and innovators in fields such as technology integration, mathematics coaching, special needs education, science instruction, and gender equity. They have founded schools, written curricula, and led classrooms in 16 different countries that stretch across every populated continent on earth.

Here, Craig Kemp, Joe Fatheree, Jim Tuscano, and Nadia Lopez weigh in on tech and teacher PD. Links to comments on the subject from 10 additional bloggers are available at www.educationviews.org/global-search-education-teachers-top-tips-designing-meaningful-pd-programs.

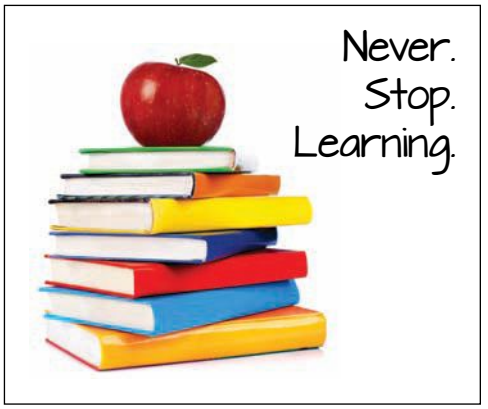
Craig Kemp

Four Ways to Improve Teacher Professional Learning

In the fast-paced, ever-changing world that we live in, teacher learning never stops. As soon as a new skill or tool is mastered and implemented, a new piece of learning is available. As teachers, we are also learners, and we control our own learning in a variety of ways. If I was calling the shots, this is how I would change professional development for teachers in my community:

- **Encourage social media use for anytime, anywhere learning.**

I am a social media addict (in a good way). I am addicted to Twitter to extend my practice, learn from others, and grow as an educator. It allows me to access what I want when I want. I can ask a question and within minutes get responses from my PLN (Professional Learning Network) from every corner of the globe. I



would encourage people to connect, explore, learn from like-minded people and embrace the changing nature of technology. Having an established online learning network is powerful and I want to share that with others.

• Establish a coaching pedagogy.

Coaching as a pedagogy or thought process changes the way people look at learning. Coaching encourages people to support, guide, and mentor. In a coaching model, you become responsible for your own learning and this allows you to take the first step to move forward with the support of those around you. You are never left on your own but you are expected to take some steps to do things on your own, increase your skill set, and push yourself to be better.

This mindset is easy to establish in a warm, caring, and open school setting and would be one of the first things I would implement to start the positive teacher learning process.

• Establish a PLN (or PLF-Professional Learning Family).

A huge step in creating a personalized learning environment for teachers is to have them create and establish a PLN through any social media they perceive best. I always encourage Twitter, as it is busting at the seams with educators wanting to connect, share, and learn from one another. The best part is that it is mostly just the positive people online, so negativity is very rare (unlike most staff rooms in schools). PLNs allow you to push boundaries and seek learning never thought possible.

I have made so many contacts through my PLN and created a network of people who are like minded and love to learn and share. These connections open up opportunities for my colleagues, students, and the wider school community. PLNs help us engage our students in the Global Classroom. To get started on Twitter, follow my 10 steps at http://mrkempnz.com/2014/09/10-steps-to-creating-the-perfect-educational-twitter-account.html.

• Make learning fun and personalized (and provide TIME).

This to me makes any learning sustainable. Just like with students, learning experiences for teachers needs to be fun, engaging, and personalized to suit their needs and expectations. I survey people, assign buddies and mentors, provide TIME for them to learn what they need to learn, and don't always dictate what learning will happen. It is crucial for organizations to have strategic goals and lead professional development related to those; however, teachers need the freedom to learn what is important to them as well and schools need to provide time, money, and resources to make this a priority.

Craig Kemp is head of educational technology at a large international school in Singapore. He is co-founder of #whatisschool, #asiaED edchats, and #pubPD. @mrkempnz

Joe Fatheree

Professional Learning: Anytime and Anywhere

Recently, while on a trip to Washington, DC, I experienced one of the best professional learning opportunities of my career. My classroom was in one of the thousands of taxi cabs that travel the city. The teacher: an Indian cab driver from Bombay. His lesson centered around the importance of people learning how to overcome the barriers of racial divide to address the needs of humanity. The message was powerful. Components of the discussion will find their way into my classroom.

As a 30-year teacher leader, I understand the importance of educators having access to high-quality professional development. Unfortunately, in the early years of my career, I naively thought it was the job of my school district to be the sole provider of the content. To be fair, that's the way the system worked.

Teachers were expected to show up on institute day to receive a healthy dose of one- size-fits-all professional development. And just like cough medicine, the worse it tasted the better it was supposed to be.

At that time, high-quality personalized professional development was like a mirage in the desert. Broadband internet found its way inside the walls of my school around 1994, and helped usher in a change of mindset. It didn't take long for me to realize the value of the information highway. I merged onto it bound for the knowledge express as quickly as the mouse and my index finger would take me. The deeper I dug, the more I understood the importance of teachers owning their professional development journey. Don't get me wrong. I believe that districts have a moral and ethical responsibility to provide meaningful professional development. However, it's critical that teachers become vested partners in the process.

Over time, I grew to understand that professional development was happening all around me. I just wasn't noticing it. The world is filled with brilliant people, just like my cabby, and they all have stories to share. I love the internet, social networking sites, virtual reality headsets, etc.

However, all of them dim in comparison to the world's greatest gift: its inhabitants. It took me awhile to understand how to take the tidbits of information I gleaned from the countless conversations I have had and package those stories in a way they could be used in the classroom setting. My teaching took a quantum leap forward once I learned to do so.

Now, I talk to almost everyone. I have learned from some of the best professional development providers

in the world. Cooks, janitors, and cab drivers are all sources of inspiration. I learned valuable lessons on collaboration from an Amish farmer while waiting at a train station in Chicago. A seamstress in an upholstery shop shared her position on grit. Sometimes the best learning experiences come from the most unlikely of places and people.

I have grown to understand the freedom and liberation that comes from owning my professional development journey. I am no longer inhibited by the constraints as to what is given me. That information is only supplemental. I am constantly searching for new ways to grow as an educator. My professional learning community is over 7 billion strong.

Interested in joining?

Joe Fatheree is an award-winning author, educator, and filmmaker. He has received numerous awards, including being recognized as a Top 10 Finalist for the Global Teacher Prize, Illinois Teacher of the Year, and the NEA's National Award for Teaching Excellence.

He currently serves as director of strategic projects for the National Network of State Teachers of the Year in Washington, DC, and is an instructor of creativity and innovation at Effingham (IL) High School. @josephfatheree

Jim Tuscano

Shifting from Ed Tech Professional Development to Professional Learning

Ed tech integration in education has been a major factor in driving 21st-century learning forward. When done meaningfully, student learning is propelled to greater heights, adding the needed rocket boost to engage all kinds of learners and to enable learning environments that welcome risk taking, innovation, and creativity.

However, tech integration can also be a source of disappointment or frustration to both learners and teachers if tech tools are used in class for technology's sake, out of fad, or worst, disconnected from the pedagogy. As I often remind teachers in my talks, tech tools alone cannot create magic in class.

Where is the magic then? It is with the teacher inside the classroom. However, for students to meaningfully use technology tools in class, teachers must be trained to design effective and relevant learning activities that allow for better learning with tech tools. So, teachers attend workshops, trainings, and conferences, learning new apps and skills that can help change the way they teach.

Yet, tech tools often change fast. App update notifications flood our mobile devices. New features are added to devices. With these changes come the obvious need to always make sure that teachers are updated with the skills (or app features) they need.

How do we sustain relevant learning or growth in teachers, who may realistically reach that saturation point where they think that there is too much to learn about tech integration?

We need to change perspectives from professional development to professional learning.

Teachers attend numerous ed tech related PDs, whether in school or in large-scale conferences. In these opportunities, the attendees join mostly one-shot workshops or seminars, often depending on the expertise or topics that will be discussed by the speaker. All attendees are seen as a single homogenous group,

putting them into a one-size-fits-all experience.

With the usual PDs, there is a traditional set up such as when the seminars or workshops are too much speaker-centered and the participants are bored or just listening to the "updates" or theories.

To be fair, professional development for ed tech integration has seen some major changes. For one, it should never just be about ideas or theories. It should involve hands-on, practical, and experiential learning. Yet, without careful planning or considerations, PD trainings can be reduced to plain skills training that may often be disconnected from the needed skills in the classroom.

So, what is missing piece in this great puzzle of professional growth? It's ownership of learning. This is where professional learning comes in. Today, professional learning experts and school leaders have recognized the importance of making ed tech training meaningful and relevant to teachers.

Professional learning recognizes the individual contexts of each teacher—the needs, challenges, and goals. In short, each teacher's VOICE must be heard. Moreover, professional learning must be authentic or applicable to their present situations because it is only when a teacher sees how a tech tool can work or improve instruction, assessment, or classroom management that he or she can truly realize the importance of that professional learning activity.

Here are six practices or tips that I do as a professional development/learning consultant and leader in our school.

1. Involve the participants in designing professional learning activities by getting pre-workshop data from the teachers. The collected data can help determine which skills or apps should be included in workshop sessions. Professional learning leaders can also dig for more information such as regarding technology skills level (basic or advanced) or teacher confidence that can further personalized the professional learning experiences.

2. Design various opportunities for professional learning to happen. Skills training is essential, but sometimes some teachers just need some realistic hands-on experience where they can practice and apply

what they are currently learning. Some educators need closer guidance through individual coaching. Some simply look for inspiration, or assurance, or validation to what they are doing. Avoid fitting all teachers into a single kind of learning activity. Consider their contexts and provide experiential, active, and collaborative learning.

3. Empower and involve the resident experts in the school. Ed tech experts are living proof of how meaningful technology integration can improve teaching and learning. Tap those who have experienced and improved much in their classrooms.

4. Give enough time for professional learning. Most of the complaints about professional learning is not solely about how the workshops sessions or training were run. Sometimes, it is simply that there is not enough time to acquire, reflect, and plan how to apply newly learned skills.

5. Tap the power of technology tools. Tight schedules, meetings, parent-teacher conferences, family life, and other commitments are already filling up teachers' time. Professional learning can happen even if the teacher is not going through a workshop or training. So why not take advantage of tech tools that can deliver bite-sized or just-in-time learning? Go beyond the school and connect with other experts via professional learning networks in social media such as Twitter or Google+ communities.

6. Sustain professional learning through providing support or individual coaching. Put in place a mentoring system so that expert teachers can continue to impart their expertise to those who may need coaching. Create a culture of learning and collaboration by allowing teachers to share their learning, mistakes, challenges, and solutions with each other.

Just as students deserve the best education, teachers, too, deserve high-quality professional learning. We, as teachers, can only impart what we know. Tech may change quickly, but our role as teachers still matters! So keep on learning!

Jim Tuscano is an education technology specialist and accredited professional development consultant. @jimtuscano

Nadia Lopez

How Can Teachers Remain 21st Century Ready without Falling Behind the Ever-Changing World of Technology?

Before there was Smartboards, we used overhead transparencies, then laptops and projectors. We relied on students raising their hands, now

there are clickers and smart phones to capture real time responses to gather classroom data.

There is no doubt that technology in education makes things faster, easier, and more accessible, but with so many changes happening at a rapid rate, what is new today will become outdated within a few months. A few years ago, I was invited to Google Headquarters in New York City for a workshop on how to create a Google Classroom that will prepare students for the 21st century. The system was easy to engage and readily accessible for educators who have little to no experience with showing how easy it could be to compose and share documents through Google Docs, create a classrooms through a Google website, and provide opportunities to conduct research and authenticate information. It became evident that Google was more than a search engine, but had an education platform with hundreds of products that could make teaching and learning fun, engaging, and cutting edge. It offers everything you need for a student to develop skills needed for college and career readiness using a computer, tablet, or even a smart phone.

While I was fascinated by what I learned at Google, it was clear that as a educational leader, in order to best develop teachers professionally, in our tech driven society one must be committed to the following:

1. Assess faculty members to determine who is able and willing to learn about the use of technology. It's important that as educators there is an open-mind to be adaptable to change and develop the patience needed to learn new things that will help improve their classrooms.

2. Evaluate what technology will make sense for the instructional practices in your school. I can't tell you how many vendors come to the school to pitch their new programs, which sound great, but rarely get used because they don't align to the school's curriculum or don't become more of hassle to use.

3. Identify a point person or create a tech team committed to attending training and will facilitate professional development for staff members to keep them informed of new products, trends, and changes.

4. Know the type of technology that is needed in the workplace to prepare kids today in our classrooms. Therefore, cultivating partnerships with organizations and individuals who can extend learning opportunities on or offsite is essential to creating a 21st century environment.

By establishing these fundamental practices, we can then focus on providing professional development that integrates the use of technology in a more profound and meaningful way that teachers can continue to learn and evolve with over time.

As the founding Principal of Mott Hall Bridges Academy, NY., Dr. Nadia Lopez is pioneering a path of inspired leadership to show the world how under-privileged communities can beat the odds and create positive institutions that have a global impact. @TheLopezEffect

To Develop Teachers, Look to Other Teachers

Mentors and a supportive principal are the biggest determinants of retention, research finds.

By Autumn A. Arnett

TEACHER training was one of the areas of the FY2017 budget measure passed by Congress that saw significant cuts, precisely at a time during which education advocates agree professional development for teachers is more important than ever.

Researchers from Michigan State University have presented the findings of a study that indicated half of early career teachers leave their schools by their fifth year, and one in four leave the profession altogether. Part of this can be attributed to a perceived lack of support by their principals, but another part is due to a lack of support and personal development that encourages persistence.

And research out of New York University's Teacher's College found that teachers are more satisfied with their jobs if they perceive their principals to clearly communicate expectations and vision, value teacher input, and if they have opportunities to discuss institutional practice. Having teacher mentors and a supportive principal are the two most critical influences on how a teacher experiences the profession in the first five years, and an emphasis on interpersonal learning and relationships is key to any teacher retention conversation, said American Institutes for Research Center on Great Teachers and Leaders researcher Catherine Jacques recently at a Capitol Hill event detailing the findings of a new report on a teacher learning study.

But it is important that any professional development efforts allow opportunities for teachers to self-select or opt-in to courses that are led by other teachers and job-embedded, focusing on collaboration.

"A lot of teachers will tell you it's 'sit and get,' and there's no engagement and no follow-up," said 2016 District of Columbia State Teacher of the Year Topher Kandik, who added most professional development efforts are led by outside consultants, rather than peers who are sharing best practices based on their daily experiences. "That, to me, just seems like a bad investment." ►

Autumn A. Arnett is the editor of EducationDIVE*, an online publication that provides news, trends, jobs listings, and resources for educators and administrators in higher education and K-12. Condensed, with permission, from a May 4, 2017, post on the EducationDIVE website. Read the post in its entirety at www.educationdive.com. Condensation appeared in the September 2017 issue of* The Education Digest.

Let Teachers Lead Their Own PD

There are multi-tiered benefits to teacher-led professional development, experts say. For one, allowing novice teachers access to teacher-leaders helps encourage the new teachers in the things they're seeing in the classroom and encourages them around sound pedagogy to up the ante on their effectiveness.

Not only that, Jacques said, but veteran teachers are strengthened along the way, and job satisfaction is boosted because they are allowed ways to make a difference in meaningful ways.

Teacher-led development also increases ownership and engagement among teachers of all levels, thus boosting the effectiveness.

"Teacher [education] enrollment is not in a great place right now—there's been a 35% drop off in the number of people enrolled in teacher education [programs] right now," said 2010 Florida State Teacher of the Year and National Board Certified Teacher, Mount Holyoke College, Megan Allen. "We've got to think about teacher recruitment and retention differently.

"If we want to keep more great teachers in front of students, teacher leadership is a great way to do that."

"Too often decisions are made in education without classroom teacher perspective—because we're in the classroom, and often it's hard to get us out of the classroom" to have these conversations, said Kandik. "We spend about $18,000 per teacher, per year on professional development. We can be more strategic and effective in the way that we're spending the money we spend, and maybe an answer to that is ask teachers what they need."

And it's less costly than other forms of professional development, meaning districts can achieve more with less—even if public funding for PD dries up.

"Relying on teacher leaders is, on the whole, less expensive than relying on" outside consultants, said Ellen Behrstock-Sherratt, a senior researcher at the Center on Great Teachers and Leaders. "By investing in teacher-led teacher learning, you're saving on the costs associated with teacher learning and also the cost associated with teacher" attrition.

It also helps with principal retention, added Katherine Bassett, 2000 New Jersey State Teacher of the Year, and current president and CEO of NNSTOY.

Identifying Advancement Pathways

U.S. Senator Chris Coons (D-DE) said schools and districts must work together to develop advancement pathways for good teachers that do not pull them out of the classroom.

If teaching is allowed to be "a career where your only opportunity for growth and promotion is to go into administration, you're not going to have great teachers in the classroom," he said. Rather, there should be a collaborative effort "to empower great teachers to be leaders."

Half of early career teachers leave their schools by their fifth year.

Jacques agreed, saying, "Having roles for teachers to move into leadership to help them really make a difference in meaningful ways" boosts job satisfaction and retention efforts.

This doesn't mean moving effective teachers from one school to the next. It does mean thinking intentionally about "what is the right kind of professional development for teachers across the state," said Behrstock-Sherratt, and identifying real paths for advancement within schools and districts.

These pathways include serving as mentors for other teachers, but also providing opportunities for teachers to serve on the school or district leadership teams.

Establishing Common Requirements

"States have a lot of freedom right now to make this a decision about what their own professional development will look like, and that's great, but some federal guidance is needed," said Behrstock-Sherratt.

"A lack of coherence in the teaching profession is expensive, ineffective, and leads to having only 3% of teachers board certified, said National Board for Professional Teaching Standards Senior Vice President, Outreach and Engagement Amber Parker, who said there must be an effort made toward "meaningfully connecting board certification to professional development needs" to encourage more teachers to become board certified.

Perhaps, said Allen, national board certification can serve as a conduit to state licensure.

"We need to re-think certification and state reciprocity," said Allen, who said differences in licensing requirements between states pushed her out of the classroom when she found herself living in a new state and being forced to start from the beginning with the licensing process.

There also should be more formal guidance around which teachers serve as mentors for other teachers, Bassett said.

However, Bassett said, "there should also be training requirements for cooperating teachers" who serve as mentors or trainers for their peers.

It can't just be "'you're an awesome teacher, so now you're a teacher mentor.' No. No, that's not how it works in any profession, except teaching," Bassett said. Policymakers also need to work on "setting a common bar for entry into the profession—which doesn't exist right now," she said. "In most other professions, there is a standard."

"We need to listen to teachers, trust teachers to make wise decisions, think more wisely about the money we spend, and revert back to 'the sniff test' of 'does this make sense' above all else," said Kandik.

And genuine efforts need to be put forth to support teachers.

"As long as the system is not designed to support teachers, you're not going to be attracting teachers," Parker said.

Not Everyone Needs a Four-Year Degree

Virginia's Trailblazing Fast Forward VA Helps Young Virginians Achieve the 'American Dream.'

By Randy Stamper, Amanda Christopher, Jim Babb, and Craig Butterworth

LUKE Storey grew up in Southside, VA, and has always been something of a ranch hand, working the fields and farms that criss-cross the rural landscape. He's become a bit of an agricultural expert in the process, almost by default: There hasn't been much else to do. Job opportunities have historically been relatively scarce in this neck of the woods.

But Storey, 19, got word of Southside Virginia Community College's Power Line Worker training school, and things began to change.

"I knew I was tired of working on different farms, insulation businesses, and stuff like that," he says. "I wanted something different and better, and I knew it was going to be hard to get a job in this industry without some sort of training. So I signed up."

After 11 weeks of intensive training, Storey became one of more than a dozen members of the school's inaugural class. He graduated, earned certificates and credentials and, more important, found a good-paying job.

"While I was in the program, I started applying to jobs and I got an offer to work with Southside Virginia Electric Cooperative, my number one choice," he says. "We graduated on a Thursday and I started work the next Monday."

Though he's still training, Storey says he's looking forward to his first real climb up a utility pole.

Being gainfully employed and doing something he likes, Storey says, have also done wonders for his self-esteem: "It makes me feel better knowing that paychecks are coming in and that I'm paying a lot of my bills on my own and not having to rely on my parents."

Instead of being asked to pay the entire cost of a training program at enrollment—the standard practice for many years—students pursuing identified high-demand credentials are charged only one-third of the cost.

A New Option, New Success Stories

Storey is just one success story coming out of Virginia's Fast Forward VA program, a first-in-the-nation, performance-based strategy to match young people with the competencies and credentials that businesses are seeking in their employees. Passed by the 2016 General Assembly and signed into law by Governor Terry McAuliffe, the program slashes student costs by two-thirds for targeted workforce training programs and opens a new path to in-demand jobs for thousands of people who might not have gone to college otherwise.

The program was implemented statewide last July, led by Virginia's community colleges. Instead of being asked to pay the entire cost of a training program at enrollment—the standard practice for many years—students pursuing identified high-demand credentials are charged only one-third of the cost. Under a unique pay-for-performance plan, the state pays the college the other two-thirds: one-third when the student completes the program, and the final one-third when the student earns the industry-recognized credential.

"There were folks who were ready and willing to take the training, but who just could not afford it," says Craig Herndon, vice chancellor of workforce development for the Virginia Community College System (VCCS). "Now, we're able to help those who didn't know we exist to get the training they need

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Randy Stamper, Amanda Christopher, Jim Babb, and Craig Butterworth are staff members at the Virginia Community College System. Condensed, with permission, from the Virginia Journal of Education*, 110 (June 2017), 8-12. Read the article in its entirety at www.veanea.org. Condensation originally ran in* The Education Digest.

to land jobs with family-sustaining wages."

These workforce training programs are based on competencies rather than traditional credit hours or seat time. Often lasting only three to six months and focused on specific skills needed by businesses, Fast Forward VA programs are offered in fields such as health care, information technology, manufacturing, transportation and logistics, and skilled trades. The resulting credentials provide a gateway to tens of thousands of vacant jobs that pay an average of $30,000 to $50,000 per year, often more.

Since the program's inception, more than 130 training programs have been approved for funding by the State Board for Community Colleges, in concert with the Virginia Board of Workforce Development. The average cost of these programs is about $3,000. The only eligibility qualification is that the student must live in Virginia (they may not be a resident of another state, nor move to Virginia to take advantage of the program). Students must also sign a promissory note, agreeing to pay the second third of the cost if they drop out or do not successfully complete the training program.

The Fast Forward VA program took off faster than anyone expected. Just nine months after its launch, more than 4,000 Virginians had enrolled, over half of those had completed their courses, and 1,300 had already earned industry-recognized credentials that have helped many secure good-paying jobs.

Importantly, Fast Forward VA's design ensures that the credentials earned are directly aligned to jobs that Virginia businesses are eager to fill. Colleges must submit proposals to the State Board for Community Colleges to receive approval for funding, making the case that there are current and projected jobs available in the college's service region that the training and credential are aligned to. This maximizes the likelihood that students will be employed when they complete their training programs and earn their credentials.

"For the money and time spent, you can't beat coming out with three certifications and walking into a full-time job," Kouri says. "It was a lot of work in a small period of time but totally worth it. I'm finishing my internship and have a job thanks to a teacher recommendation."

Which is just what Kouri Tweedy did, going from holding two part-time jobs with no career path to three credentials and a full-time job in the health care field in a matter of months. Tweedy, a 24-year-old student at Central Virginia Community College (CVCC), admits that school was not her favorite thing and that her employment history was unstable, but she wanted to start on a career path. She heard about the Fast Forward VA program at her local Virginia Employment Commission Office and decided to apply.

Through Fast Forward VA and financial assistance for noncredit training, Kouri took classes at CVCC over a four-month period. She earned the following certifications: Certified Clinical Medical Assistant, EKG Technician, and Phlebotomy Technician, by the American Medical Certification Association.

"For the money and time spent, you can't beat coming out with three certifications and walking into a full-time job," Kouri says. "It was a lot of work in a small period of time but totally worth it. I'm finishing my internship and have a job thanks to a teacher recommendation."

She'll make more money in her new career than in her two previous part-time jobs, using her newly earned certification as a Certified Clinical Medical Assistant to work with patients, conduct lab work, provide emergency medical services, and assist doctors.

"I'm sure the medical field is where I want to continue," Kouri says. "I want to continue taking classes and hopefully one day become a nurse practitioner. The Fast Forward VA was my gateway to that path. It really opened my eyes to realize how important education is and showed me that if you push through it, you will go places, both personally and financially."

Fast Forward VA's History

The Fast Forward VA program is Virginia's response to the changing workforce needs of the Commonwealth's businesses. In 2015, the General Assembly, recognizing the high number of jobs that require more than a high-school diploma but less than a bachelor's degree, directed Virginia's Community Colleges to develop a plan to expand the number of workforce training credentials and certifications to meet the demands of Virginia's workforce.

Fast Forward VA was established to:

- Create and sustain a demand-driven supply of credentialed workers for high-demand occupations by addressing and closing the gap between the skills needed by workers in the Commonwealth and the skills of the available workforce;
- Expand the affordability of workforce training and credentialing; and
- Increase the interest of current and future Virginia workers in technician, technologist, and trade-level positions to fill available and emerging jobs that require less than a bachelor's degree but more than a high school diploma. Glenn DuBois, chancellor of Virginia's Community Colleges, spent the summer of 2015 meeting with business, civic, and educational leaders across Virginia to discuss the realities of the 21st-century workplace. These discussions confirmed recent research showing that the workforce training needs of Virginia families and businesses were outpacing the Common-

wealth's existing policy structure and resources.

Comprehending that misalignment requires an understanding of the staffing ratio consistent throughout today's workplace—the 1-2-7 ratio. In general, for every one job that requires an advanced degree, there are two jobs that require a bachelor's degree, and seven jobs that require postsecondary training that leads to an associate's degree or industry-recognized credential beyond a high-school diploma, but not a four-year degree. Those missing sevens, felt throughout Virginia's economy, are the jobs the Fast Forward VA program works to fill.

What's Next

Approaching its second year, Fast Forward VA will continue to expand quickly, and Virginia's community colleges are adding elements to ensure that students are successful both in the classroom and the job search. This summer, each college will hire a full-time workforce career and credential coach, who will work closely with students enrolled in Fast Forward VA programs to help ensure they complete their training, earn their credential, and find and keep a job in their chosen field.

Additionally, colleges will continue to expand their use of financial aid to support Fast Forward VA programs. Because Fast Forward VAs are not traditional, credit-based programs, they do not qualify for federal financial aid.

Recognizing this, the 2017 General Assembly and VCCS identified $2 million in state funding to support Fast Forward VA programs for students who cannot afford to pay for the first third of program costs. This means that qualifying students can pay as little as 10% of the first third. In some cases, that means that the student's share could be less than $100.

Moving forward, more programs will be added under Fast Forward VA, and a statewide outreach campaign will be launched to let more students, families, and businesses know about the opportunity.

For more information on the Fast Forward VA program, visit www.fastforwardva.org.

More People with Autism Are Getting Training for Technology Jobs

Some worry the push forecloses other job prospects

By Arianna Skibell

WHEN Joseph Leogrande, 18, rides the subway, his caretaker reminds him to be aware of his body and space, not to stand too close to people. Sometimes it's hard for Leogrande to concentrate on these directives—his mind is elsewhere. He likes to move to the front of the train and peer into the cab, where the driver sits. "I want to see how everything works," he said.

Since Leogrande was a kid, he's collected extension cords and traffic signals from the MTA. He likes to take old things and make them work again, like a broken old-fashioned touch-tone phone he recently fixed.

"It had no phone cord," said the curious young man, who is on the autism spectrum. "I had to wire one, and I had to program it. It took a little time to figure out the contacts, but in the end I figured out the proper screws and I got it working."

Leogrande said he isn't sure what he'll do professionally, but he wants to work with technology: computer programming or maybe electrical wiring. He knows he's capable, but those around him worry it might be hard for him to find a good job. Their fear is not unfounded. Advocates for those with autism estimate that up to nine out of 10 adults with autism are unemployed or underemployed.

Advocates for those with autism estimate that up to nine of 10 adults on the autism spectrum are unemployed or underemployed.

But a growing group of educators see technology work as an ideal field for some adults with autism and hope that tech can provide a career path and a means to financial security. At the same time, employers are beginning to see advantages to hiring people with autism, many of whom have strengths that lend themselves to working well with technology, such as being able to stay focused for long periods of time and to perform repetitive tasks with accuracy. Some critics, however, say this push could pigeonhole people with autism, focusing them too much on one interest while ignoring other potential career fields.

"It's not a pretty picture at the moment," said David Kearon, director of adult services at Autism Speaks. "People with autism are quite capable of lots of different types of work, but they're not given the opportunities."

Arianna Skibell

Joseph Leogrande, who is on the autism spectrum, learns to make a podcast with the education nonprofit Tech Kids Unlimited (TKU).

Arianna Skibell writes for The Hechinger Report. *This article was originally published on* The Hechinger Report *website, www.hechingerreport.org.* The Hechinger Report *is a nonprofit, independent news website focused on inequality and innovation in education.*

Over the last 40 years, the decline in manufacturing jobs and increase in service jobs, which usually require social interactions, has made employment more challenging for a population that tends to struggle with social etiquette and has had few options outside of low-wage labor jobs.

But things are starting to change. This year Microsoft launched a pilot program to hire adults with autism. SAP Software & Solutions announced that by 2020 it plans to hire 650 autistic employees, one percent of its workforce—nearly the same proportion of people with autism in the general U.S. population. And others are following suit, seeing this community as an untapped, and potentially industrious, labor force.

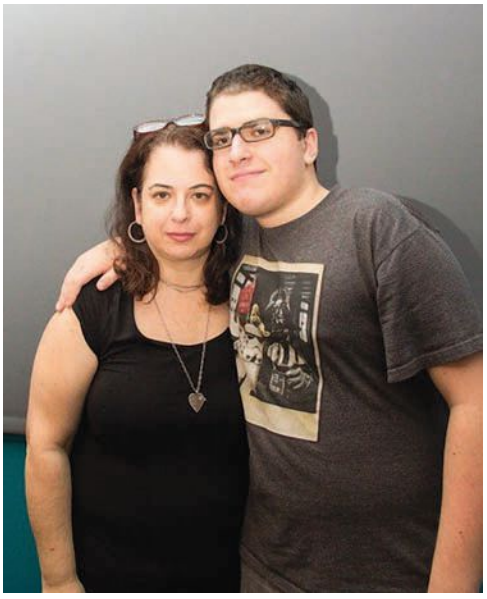


Photo courtesy of Beth Rosenberg

Beth Rosenberg and her son Jack started the education nonprofit Tech Kids Unlimited to teach children with special needs how to be technology producers in addition to consumers.

To prepare students with autism for these and other tech jobs, education programs nationwide are stepping in to introduce technology training at an early age. In California, STEM[3] Academy, which teaches science, technology, engineering, and mathematics skills for high school students with special needs related to autism spectrum disorder, announced last month that it's expanding to serve middle school students.

In New York, Leogrande developed the skills he needed to fix that old-fashioned phone at a tech education nonprofit called Tech Kids Unlimited (TKU). Beth Rosenberg, a mother and educator, founded the organization after she realized there was nowhere that would teach her son Jack, who has special needs, how to turn his passion for technology into marketable skills.

For the last few years, TKU has offered in-school and after-school workshops as well as weekend and summer programs in which students learn everything tech, from computer programming and animation to 3D printing and website development. Each TKU classroom has a three-to-one ratio of students to teachers and social workers. And the students have many opportunities to practice so-called "soft skills," like ordering lunch or negotiating whose turn it is to play Nintendo Wii.

"Our students, if exposed, really can keep up and can be really great technological producers," Rosenberg said.

At a recent workshop, students learned how to use audio software to create podcasts focused on their areas of interest.

"Paris Metro Broadcast," one student's podcast began. "Hi, my name is Bennet Cook and I will talk about the Paris Metro system and its history."

In his podcast, Cook, 16, laid out plans for expanding and streamlining the Paris Metro so that it can grow efficiently as the population grows.

"I first noticed it when I was reading a book called 'Paris Underground,'" he said. "And then it really got me thinking, what if I could extend the system itself?"

In creating transit maps, Cook said his brain takes a picture of the current map and revises it for the future.

Advocates believe this kind of passion should be valued and celebrated.

"Society is made stronger with all kinds of minds," Rosenberg said. "And we know that kids at Tech Kids Unlimited are kids whose brains are just like mini computers, they're just like mini databases, and shouldn't those kids be the ones who are working in society in wonderful jobs where they can use their talents?"

"Society is made stronger with all kinds of minds. And we know that the kids at Tech Kids Unlimited are kids whose brains are just like mini computers, they're just like mini databases, and shouldn't those kids be the ones who are working in society in wonderful jobs where they can use their talents?"

Beth Rosenberg, founder, Tech Kids Unlimited

Kearon of Autism Speaks said it makes sense that some people with autism thrive in tech environments, which tend to be predictable, systematic, and rule-based. But he also stressed that everyone on the spectrum is an individual, with individual interests and skills.

"The autism spectrum is so wide. We know people with PhDs who are mechanical engineers and doctors and professors," he said. "We also know that there are a lot of people with autism who struggle with daily activities, getting themselves up and out of the house and living in a safe way."

And not everyone on the spectrum likes technology. One young girl at the podcast workshop said she was only there because her parents had signed her up. ►

"I just like to shop online," she said.

Stephen Shore, a professor at Adelphi University in New York who studies autism, said encouraging children on the spectrum to follow their own passions can have a positive impact—as it did for him.

"After 18 months of typical development, I was hit with what I call the autism bomb," he said. "Which happens to about half of us on the autism spectrum."

"People are recognizing their strengths and so we're seeing more and more programs developed that are designed to get people with autism to get jobs, which is awesome."

David Kearon, director of adult services at Autism Speaks

Shore lost the ability to communicate, had repeated meltdowns, and withdrew from his environment. His parents refused to institutionalize him, and instead enrolled him in an intensive early intervention program. When he was four, his speech returned.

In school, he said, he didn't know how to get along with his classmates, bullying was pretty bad, and his teachers didn't know how to teach him. But he had his special interests.

"I would go into the library and pull out all the books in my favorite subject, whatever it was at the time—maybe electricity, aviation, space exploration, earthquakes, whatever it was," he said. "And I remember in third grade, I had a stack of astronomy books on my desk and the teacher told me that I'd never learn how to do math. But fortunately, I've learned just enough math to teach statistics at the university level."

Shore now divides his time between researching and teaching courses about autism, traveling around the world consulting, writing books on the subject, and giving music lessons to children on the spectrum.

He said that, regardless of profession, the most heavily weighted variable in career success is social interaction—often a challenge for people on the autism spectrum. Shore leads workshops for people on the spectrum to teach them how to interact more successfully with others in the workplace. But, he said, it ought to go both ways.

"It's also a matter of educating employers and society in general for interacting with people on the spectrum," he said.

And this is starting to happen. Kearon said lately he's seen a lot more interest from businesses that want to learn.

"They want to talk to us, they want to meet people with autism and they want to train their staff," he said. "People are recognizing their strengths and so we're seeing more and more programs developed that are designed to get people with autism to get jobs, which is awesome."

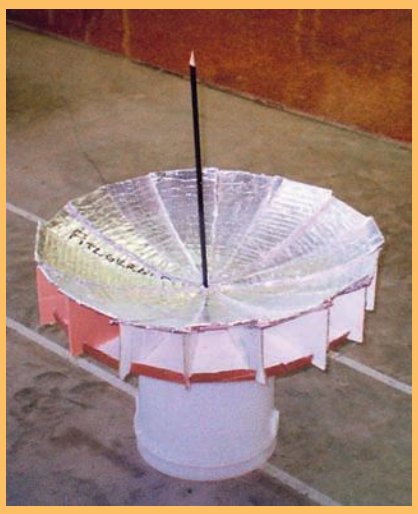
The nonPareil Institute in Texas provides technical training, employment, and housing for people on the spectrum. Specialisterne, a nonprofit founded in Denmark, assesses the strengths of people with autism and then trains them as IT consultants and for other technology jobs around the globe. In San Francisco, The Specialists Guild trains adults with autism for tech jobs in Silicon Valley. And Autism Speaks offers a "tool kit" for businesses that want to learn more.

Stephen Shore is a professor at Adelphi University who studies autism and leads workshops to help people with autism develop social skills.

Photo courtesy Stephen Shore

"I cannot give you numbers, but there is for sure a rising awareness among employers of the quality of services provided by autistic persons," said Thorkil Sonne, a team member at Specialisterne.

As for Leogrande, he's not too worried at the moment. First, he has to finish high school. And right now, he's more focused on fixing the antique, albeit broken, television set he finally convinced his grandmother to give him.



Cookin' with Sun

Design and Build Solar Cookers

By Lance Brand, Ande Warren and Mike Fitzgerald
mfitzger@doe.state.in.us

HAVING students design and construct solar cookers is a great way to teach them about designing to meet human needs and about many basic global issues related to health and the environment. And, because the activity includes solid content from the fields of math, science and technology, it's an excellent vehicle for technology educators who want to increase academic content in a hands-on activity that really motivates students.

Through studying solar energy, students can learn how to reduce energy consumption and pollution. They can learn how to apply solar technologies to aid in heating water for cleaning, hygiene and bathing. They can also investigate solar technologies and their applications in generating electricity and the heating of homes.

Objectives

Students will be able to:

- Identify three basic kinds of solar cookers.
- Select a solar cooker design to best meet the design challenge.
- Construct a working model of a solar cooker.
- Learn how rays of light are converted into heat energy.
- Learn how heat energy is collected and retained.
- Learn how the sun's rays are best collected and directed to generate heat.
- Identify three advantages and disadvantages of solar cooking.
- Work as part of a team to solve a technical problem.
- Describe how solar energy can be used in practical applications for society.
- Demonstrate and present technical information based on the application of solar energy.

Lance Brand is a physical science teacher, Delta High School, Muncie, IN; Ande Warren is a technology education teacher, Greencastle (IN) Middle School; and Mike Fitzgerald is a technology education specialist, Indiana Department of Education, Center for School Improvement and Performance, Indianapolis.

Cookin' with Sun

Design and Build Solar Cookers

Energy Essentials

We can describe energy as the ability to do work. Without sophisticated energy use, the technologically advanced world that we live in today would be impossible. Energy powers the machines, lighting, heating and cooling systems that make our lives comfortable. Much of the work that we perform is accomplished through the conversion of energy.

We can view energy as having many forms: mechanical, electrical, light, thermal, chemical, sound and atomic. *Potential* energy is stored energy that can be transformed for use. For example, gasoline contains stored chemical energy. Through its combustion, we can produce the mechanical energy needed to power an automobile. In doing so, we transform potential energy (gasoline) into *kinetic energy* (motion).

Human use of energy includes the collection, redirection and transformation of energy from one form to another. For example, all of the items below use energy through these processes:

- Toasters change electrical energy to heat and light energy.
- Lamps change electrical energy to light and heat energy.
- Speakers change electrical energy to sound energy.
- Candles change chemical energy to light and heat energy.
- Electric motors change electrical energy to mechanical and heat energy.

We can further classify energy in several forms: *exhaustible*, *inexhaustible* or *renewable* resource.

Exhaustible energy resources cannot be replaced once they are used up. Examples include fossil fuels (e.g., coal, natural gas, oil) and nuclear energy. Researchers estimate that fossil fuels currently account for nearly 77% of the energy used today. Human dependence on fossil fuels has produced pollution that creates both environmental and health problems. Nuclear energy offers great potential for meeting our energy needs, but also presents concerns related to possible nuclear plant accidents and waste storage concerns.

Renewable energy sources can be used indefinitely. Wood is the leading renewable resource, accounting for 15% of energy used worldwide. One promising renewable technology uses *bioconversion* to create fuel from plant material and animal waste. Ethanol, a combination of alcohol and gasoline, is another bioconversion product that may address significant transportation, heating and cooking needs in the future. Some urban areas are studying the feasibility of using bioconversion in large incinerator facilities that would produce electricity from trash and garbage.

Inexhaustible sources of energy have always been available to people. Examples include wind, water, geothermal and solar energy. These forms of energy create the least amount of environmental impacts from pollution. Historically, people have used wind energy to power ships, pump water and grind grain. Today wind energy is used to produce electricity. Water has powered machines that grind grain, saw wood and generate electricity. Geothermal energy, heat that comes from the earth's interior, can be used for heating, cooking and producing electricity.

Solar energy consists of heat and light energy that moves in the form of electromagnetic waves. (Note here that we can describe the sun as a large ball of energy in the form of exploding hydrogen gas. It is basically a large nuclear reactor!) Solar energy represents a solution to our dependence on fossil fuels that has little harmful effect on the environment. In many parts of the United States, solar energy is now used to some degree to heat homes and water. Photovoltaic cells, first developed about 50 years ago, convert light energy from the sun to electricity. This technology is used to power devices such as the common calculator and, in remote areas throughout the world, to generate electricity. Though use of solar energy in many circumstances is not yet economically feasible, researchers are working to perfect large-scale applications.

Cookin' with Sun

Design and Build Solar Cookers

Solar Cooking

Preparation of food varies worldwide. In developed areas, most cooking is done over a gas or electric burner. People in many underdeveloped parts of the world cook over fires that use materials like wood, trash, dried dung and coal as fuel. Problems arise related to pollution and the diminishing availability of fuel sources.

Solar cooking presents a potential solution. It produces little pollution and can be used in most parts of the world with good results.

The Earth receives almost 20,000 times more energy from the sun than we currently use. If we can learn to use the sun's energy effectively, we can reduce our dependence on both fossil fuels and renewable fuels.

A solar cooker, which traps and focuses the heat of the sun for cooking food, uses three main principles: *reflection*, *conversion* and *retention* of the sun's rays. Sunlight focuses on a solar cooker to heat the food inside. In many designs, added reflectors increase the solar energy. Solar cookers can be made from very simple materials—cardboard, crumpled newspaper for insulation and aluminum foil for reflectors. Lower-quality designs may reach internal temperatures of 250°F, while higher-quality cookers may get up to 425°F!

Both visible light and ultraviolet (UV) radiation are collected and focused to raise temperatures in solar cookers. UV light is radiation from the sun that has more energy than visible light. Both UV light and visible light are forms of energy composed of electromagnetic waves.

Solar Cooker Design

Cost is one of the most important considerations in the design of a solar cooker. A cooker should be affordable to people living in underdeveloped parts of the world. Beyond cost, the designer must consider convenience. A good design would be easy to use, move, clean and store. The designer must also address such concerns as durability, maintenance, safety and stability. The cooker should be easy to repair with simple materials and tools.

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Cookin' with Sun

Design and Build Solar Cookers

Design Brief

The Problem

You and your group are on a rescue-training mission in which a helicopter has dropped you off in the middle of the desert. The command center will be waiting to see if you make it back. So far, your group has not had trouble catching small animals (perhaps represented in this activity by marshmallows or hot dogs).

The problem is no one wants to eat the food raw. You need to find a way to cook with the sun's energy. You and your team must work together to build a solar cooker that will get hot enough to cook your food. Otherwise, you may spend a very hungry night in the desert!

Successful solar cookers will:

- Focus the greatest possible amount of the sun's light rays through *reflection*.
- *Convert* the greatest amount of light waves into useful thermal (heat) energy.
- *Retain* the greatest amount of heat from the sun.

Solar cookers take one of three basic forms:

Box cookers have the advantage of slow, even cooking of large quantities of food. Box cookers are usually built using two to three boxes stacked inside one another. They use reflective panels to focus the energy of the sun into an inner box. This type of cooker will not create the greatest amount of heat, but it might be the easiest to make. A great variety of reflection and heat retention designs can make a box cooker even more effective.

Parabolic cookers are generally concave dishes that focus solar radiation onto the bottom of a pot. The major advantage of this design is that foods cook about as fast as on a conventional stove. The parabolic design can reach extremely high temperatures in just a few minutes in direct sunlight. The disadvantages are that they are complicated to construct, must be focused often to follow the sun and do not function well on cloudy days.

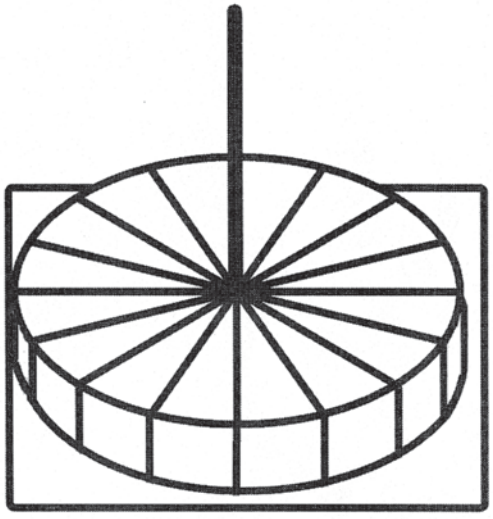
Panel and funnel cookers use various flat panels to concentrate solar rays into a pot inside a plastic bag or under a glass bowl. Compared with a parabolic cooker, this model is less susceptible to the direction of the sun's rays. This style of cooker proves most successful on cloudy days.

Materials
Cardboard
Protractor
Ruler
Large straightedge
X-acto knife
Hot glue gun
Hot glue sticks
White glue
Paste stick
Scissors
Aluminum foil

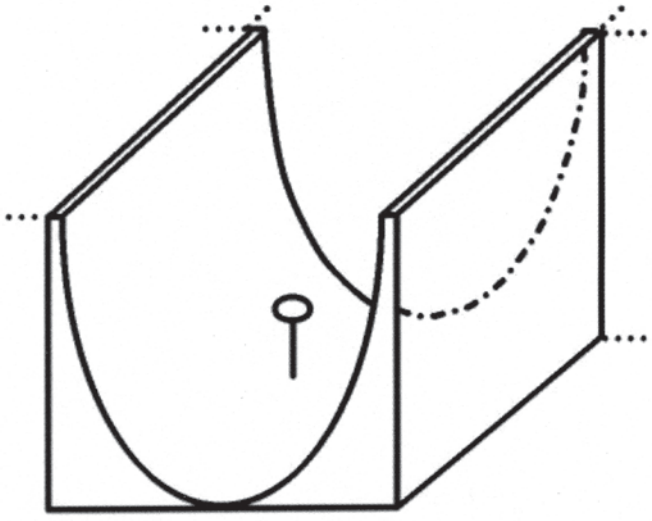
Cookin' with Sun

Design and Build Solar Cookers

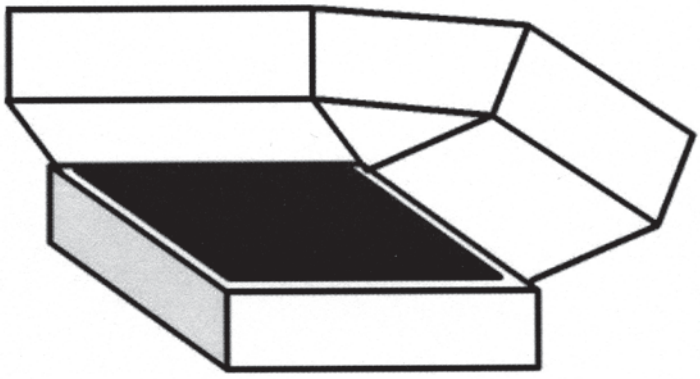
Types of Solar Cookers



Parabolic dish cooker



Parabolic trough cooker



Box cooker

Cookin' with Sun

Design and Build Solar Cookers

Design Specifications

Your group's solar cooker *must* be built with the following design criteria:

1. Your solar cooker design entry must first be approved by your teacher.

2. The solar cooker must be portable and not weigh more than 10 lbs**.**

3. Dimension should not exceed *2.5′ long* × *2.5′ wide* × *2′ high*.

(Note here that if you design your solar cooker so that it collapses, you can create a much larger solar cooker.)

4. The cooker should be capable of reaching a *minimum temperature of 100°C or 65°C above the control temperature.*

5. The solar cooker must have a cooking area no smaller than *2″ deep* × *6″ length and width*. The cooking area and the solar cooker must have a *thermometer access opening* to allow for temperature readings (a small pencil-size hole is recommended). (Note that your team might use a coffee can, aluminum pan or small box as a cooking area.)

6. Your solar cooker *may not* use any source of power other than the sun.

7. Your solar cooker will be tested using a lab thermometer and must have a place to test the temperature of the cooking area. All cookers will be tested on the same day.

8. You *may not* use foam insulation, fiberglass, plywood or breakable or harmful substances like glass or toxic spray paint.

9. In constructing your solar cooker, you may use aluminum foil, cardboard, sticks, wire, newspaper, white or black paper, plastic film (such as Reynolds oven cooking bags or Saran wrap), sawdust, Plexiglas (*2′* × *2′ max.*), tempera paint, glue and tape. (Obtain your instructor's permission before using other materials.

10. Your project must clearly and permanently label each team member's name.

Research (15 pts.)

Using the Internet and other library sources, find three different solar cooker designs. Turn in three individual pictures of the designs that you might want to build for your project. (Don't print more then one page for each design.) Staple your information together with your full heading in the top right corner. Start by doing a keyword search, such as "solar cooker" + designs.

Problem Solving and Design Documentation (85 points)

Each student group must complete the following:

1. On a separate piece of paper, your team must develop a problem statement. The problem statement should describe *all the problems* that your group must overcome to complete the design goal for your solar cooker. Be sure to discuss heat loss and gain through conduction, convection and radiation. Then, address the following issues in separate paragraphs: wind and stability, insulation and heat retention, method for focusing the sun's energy, materials you will need and which team member will get them. Conclude with a one or two paragraph explanation of your design.

2. A *full-page* sketch of your solar cooker, ***including measurements and labeled parts.***

3. Your design entry must include a full heading with the names of each group member.

Cookin' with Sun

Design and Build Solar Cookers

Sunny Dayz Solar Cooker

Here are procedures for an example parabolic dish solar cooker:

1. Select the diameter of cooker to construct on a large square of cardboard. Metric scale suggested. If you use a standard fractional scale, you will need to convert to decimal equivalents.

2. Draw the radius of the circle on the cardboard. You can use a string, tack and pencil for this operation.

3. Use the radius and diameter sizes as the base measurements to calculate and construct the patterns for 16 ribs and 16 pie pieces.

4. Divide the circle into 16 22.5° parts. Draw lines on the cardboard as shown in the diagram on page 32.

5. Neatly hot glue the ribs on the radius lines to form a dish-shaped skeleton/frame.

6. Cover each pie piece with aluminum foil. Glue the foil neatly and allow to dry.

7. Neatly hot glue eight of the pie pieces to the top surface of every other rib section.

8. After the glue dries, glue the remaining eight pieces. The pieces will overlap on top of the sections not yet covered to form a parabolic dish.

9. When the glue has dried, repair or strengthen as necessary to improve durability.

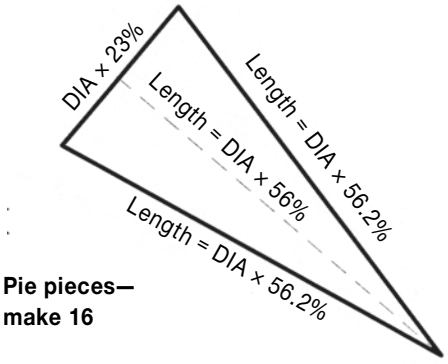
10. Poke a 3/16" dowel rod through the center. Experiment to locate the focal point of the parabolic reflector. It is estimated that the focal point is a little less than the radius of your cooker.

11. If your instructor OKs it, place a hot dog or marshmallow on the stick and make lunch!

Cookin' with Sun

Design and Build Solar Cookers

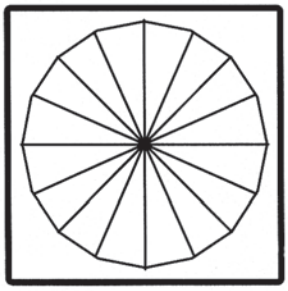
Sunny Dayz Solar Cooker

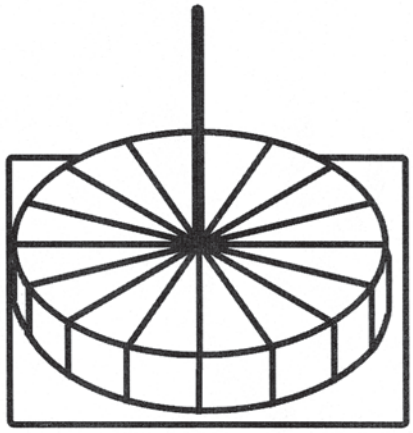


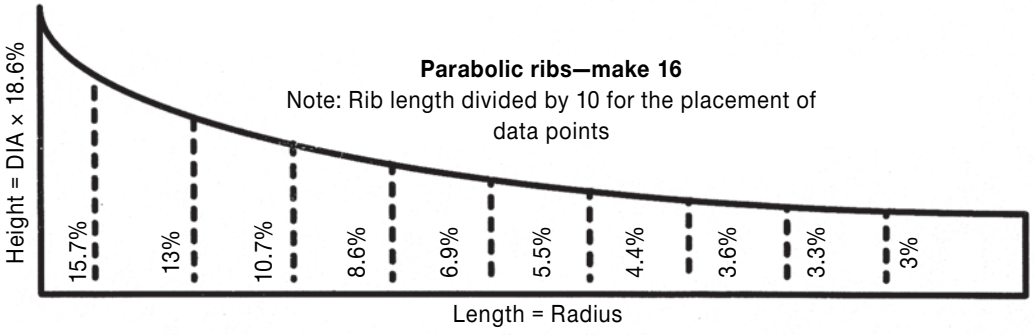
Pie pieces—make 16

Top View

Use a protractor. Divide the circle into 16 pieces that are 22.5° apart.







Parabolic ribs—make 16

Note: Rib length divided by 10 for the placement of data points

Cookin' with Sun

Design and Build Solar Cookers

Safety in Solar Cooking

1. Practice the same precautions that you would use in cooking with a stove or oven. Be aware of hot surfaces to prevent burns.

2. Practice safe food preparation guidelines.

3. Do not eat food from cookers that have been constructed from or use materials/chemicals that could potentially contaminate food.

4. Practice eye safety precautions. Never look directly into a solar cooker. The flash from the focal point of a cooker is potentially blinding. Eye damage could result. Approach all cookers from behind the focal point.

5. Wear protective sunglasses when approaching cookers to help prevent a focal flash from occurring.

Cookin' with Sun

Design and Build Solar Cookers

Name: _____

Date: _____ Class: _____

Project Grading Rubric
(200 points possible)

Description	Points
1. Research	15
2. Problem solving and design entry	85
3. Your solar cooker works. You were able to get you cooker to reach the minimum temperature of 100°C within the allotted time period.	40
4. Craftsmanship, creativity and meeting design criteria	35
5. Data collection and results	25
Internal Temperature Reached	**Points**
100°+ (or 65° above control)	40
55° above control	35
45° above control	30
35° above control	25
25° above control	20
15° above control	10
Less than 15° above control	0

Cookin' with Sun

Design and Build Solar Cookers

Name: _____

Solar Cooker Data & Results Worksheet (25 pts.)

Each student must collect data on their solar collector. Collect and record temperature readings on your solar cooker every five minutes.

Temperature of Control _____ °C

Time	Water Temperature of Cooker (°C)
0 min.	_____
5 min.	_____
10 min.	_____
15 min.	_____
20 min.	_____
25 min.	_____
30 min.	_____
35 min.	_____
40 min.	_____

On the back of this paper, create an *XY* graph (scatter plot) of your results. Be sure to include a graph title, full heading, *X* and *Y* axis labels with units and a completed graph. Below your graph, write two paragraphs describing how well your solar cooker worked, what went wrong, what would you do differently, what worked well.

Cookin' with Sun

Design and Build Solar Cookers

Safe Food Preparation Guidelines

1. Use foods that have been processed for safety. Select and use foods that have been washed and inspected.

2. Always cook and reheat food thoroughly. Cooking food fully will kill most disease-carrying pathogens and organisms. Be certain that a temperature of at least 70°C has reached all parts of the food. Never consume raw meat, fish or poultry.

3. Consume cooked foods immediately. As foods cool, microbes may begin to grow on the food. Always consume cooked foods before they cool to room temperature.

4. Prevent contact between cooked and raw foods. Tools used in the preparation of raw foods should not come into contact with cooked foods. For example: a cutting board and knife that was used to prepare a food for cooking should not be used again until it has been thoroughly washed and cleaned to prevent the reintroduction of disease-carrying organisms.

5. Keep your hands clean. Always wash your hands immediately before and after preparing raw foods. Also wash your hands between preparing other raw foods.

6. Keep all kitchen surfaces clean. All surfaces, tools and utensils and wash cloths should be suspect to cross contamination of foods unless they have been thoroughly cleaned.

7. Always protect all foods from contamination from insects, rodents, birds and other animals.

8. Use safe, clean water.

Cookin' with Sun

Design and Build Solar Cookers

Solar Cooker Extension Activity

Students will prepare an instruction manual to both demonstrate the extent of knowledge gained in this activity and meet state and national proficiencies in language arts. Students should begin by bringing a variety of instruction manuals to class for discussion. Note that instruction manuals generally contain:

- Introduction to the product and how it works
- Table of contents
- Safety concerns
- Product features
- Parts and functions, how to's, operation instructions, etc.
- Potential problems and troubleshooting guidelines

From this discussion, the teacher and the students should then establish guidelines for the creation of an instruction manual for the solar cookers that the students constructed.

Cookin' with Sun

Design and Build Solar Cookers

Design Brief

Solar Cooker Manual

You have survived your mission in the desert. You must now produce an instruction manual for the training of future rescuers regarding how to construct, use and maintain a solar cooker. You will use both written directions and detailed diagrams to provide instructions for future training missions.

Organizing Your Manual

Your final document should be single-spaced and include the following:

- **Cover page—**Title, your name, date and class.
- **Manual cover—**Picture/art of your cooker, title and features.
- **Table of contents**
- **Introduction—**Describe in detail how a solar cooker operates (the general science of solar cooking) and how your design works.
- **Safety procedures—**Describe the guidelines for safely using a solar cooker.
- **Steps and explanations—**Provide logical steps of how to use your solar cooker in the command form of verbs (wrap, twist, bend, etc.). Then provide a detailed explanation following each step. The steps should be numbered and must be written in the "command" form.
- **Problems and troubleshooting—**Describe problems that an operator may encounter and how to address or fix them.

For example, if you were writing an instructional manual about climbing a rock wall, you might have a "step" and an "explanation" that reads something like this:

*** Step 4**. Reach above your head with left hand and grasp the rock or crevasse with fingers then raise your right leg and place your foot on a projected part of the rock.

Explanation: Even though you may have your fingers in the right places, if you don't squeeze down hard with your fingers, you may fall. This pull works in a series of movements between your feet and hands. If you can't get a firm grip with your fingertips or hands, feel around until you find a good handhold. You have to experiment to find exactly the right position for each finger. Sometimes you need to roll your fingers apart in different configurations. The same with your feet. Be patient and keep trying. It takes a while to get it right.

- **Conclusion—**Non-expert readers will need a conclusion to explain the process as a whole, its description, its advantages and/or limitations.
- **Reference list—**To help with your explanations, look at a book or other reference material on instruction manuals and solar cookers or solar cooking. Be sure to cite the source. Sources should be recent—within the last five years. If you need help finding sources, ask your instructor.

Cookin' with Sun

Design and Build Solar Cookers

Evaluation Criteria for the Manual

The instruction manual will build on the skills you have been working on in class. The instruction manual for the solar cooker lets you to communicate the knowledge that you have gained in this activity. Your instruction manual must use both good organizational skills and diagrams. You will produce assembly drawings, parts diagrams (and/or materials list) and safety precautions on the construction of your solar cooker. The instruction manual will be used to establish that you know how to build, maintain, control and use the selected solar technology.

When the teacher evaluates your instruction manual, he or she will look for evidence that you:

1. Establish a belief in your introduction and conclusion.

2. Demonstrate first-hand knowledge (experience).

3. Use at least one outside source to strengthen understanding.

4. Show an awareness of the reader's basic level of knowledge on solar energy and construction procedures in your explanations.

5. Use a series of graphics or drawings to enhance your written instructions.

6. Work and place emphasis on:
   - Improving sentence structure(s).
   - Improving word choices.
   - Avoiding being "wordy."
   - Using punctuation correctly
   - Proofread carefully

Cookin' with Sun

Design and Build Solar Cookers

Vocabulary Development

photovoltaic cell _____

renewable energy _____

fossil fuels _____

exhaustible energy _____

inexhaustible energy _____

environmental impacts _____

geothermal _____

pollution _____

hydroelectric _____

bioconversion (biomass) _____

energy reserves _____

nuclear energy _____

box cooker _____

photosphere _____

law of the conservation of energy _____

solar cell _____

panel cooker _____

funnel cooker _____

Cookin' with Sun

Design and Build Solar Cookers

parabolic cooker _____

parabola _____

heat _____

circumference _____

radius _____

aperture _____

efficiency _____

focal point _____

focal length _____

reflection _____

conversion _____

heat retention _____

conversion _____

energy _____

temperature _____

heat gain _____

insulation _____

Supplier Directory

Whatever your classroom or lab needs, you'll find manufacturers and vendors here that can help you. The fields each company serves appear in bold type.

When you contact a company, please let them know you saw their listing in **tech**directions!

3 Rocks Technology
PO Box 8836
Alta Loma, CA 91701
909-297-5173; 909-532-5780
www.3rockstech.com
info@3rockstech.com
Electricity & Electronics, Energy/ Power, Engineering/Pre-Engineering, Manufacturing, Hydraulics/ Pneumatics

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1-J—A **GYROSCOPE**, while spinning, tends to retain its position in space.
2-B—A **HOROSCOPE** is a diagram used by astrologers that shows the position of our sun's planets on specific dates.
3-I—A **KALEIDOSCOPE** uses a group of mirrors to reflect multiple images of a pattern of small colorful objects.
4-F—A **KINESCOPE** is the picture tube in a television set.
5-A—An **OSCILLOSCOPE** is an electronic device that can display a graph of periodic electrical signals.
6-G—An **OTOSCOPE** is a device for viewing the inner ear and ear drum on a video screen.
7-D—A **PERISCOPE** uses mirrors to view scenes above obstructions present at normal eye levels.
8-H—A **SPECTROSCOPE** passes light through a glass prism that separates it into its particular spectrum of colors.
9-C—A **STEREOSCOPE** permits each eye to see only one of two slightly different views of an object as one would normally see them, thereby producing a single 3-D picture.
10-E—A **STETHOSCOPE** is used to channel the weak sounds produced by the human heart or machinery directly to the listener's ears with a minimum of interference.

A Fish Story
The fish was 72 inches long.
Let b = length of body.
Let t = length of tail.
then t = 9 + 1/2 b and b = 9 + t.
Solving simultaneously, b = 36" and t = 27".

more than fun

Join Us for Lunch?

Three explorers and three cannibals wish to cross a river.

There is a boat that can carry up to three people, and both the explorers and the cannibals can row the boat.

However, the cannibals can never outnumber the explorers (either in the boat or on shore) or the cannibals will feast upon the explorers.

What is the smallest number of trips needed to make the crossing?

Puzzle devised by David Pleacher, www.pleacher.com/mp/mpframe.html

Finicky Grandma

My grandmother likes coffee but hates tea.
She likes apples but dislikes bananas.
She likes beets but hates turnips.
She likes cookies but dislikes fudge.
She likes cool things but hates hot things.

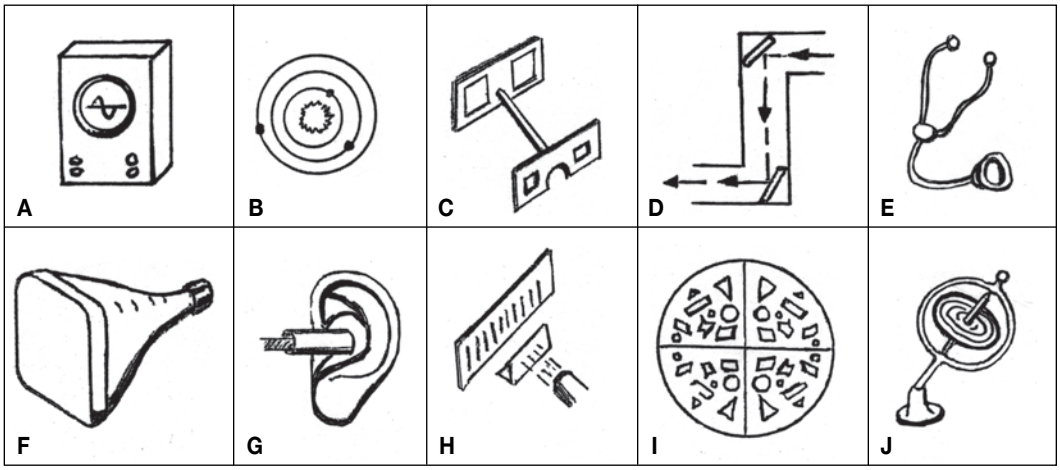
Which of the following do you think she would like?

ORANGES	**FIGS**	**ROLLS**	**PUDDING**
BISCUITS	**PORK**	**BREAD**	**POTATOES**
LETTUCE	**RADISHES**	**ONIONS**	**CARROTS**
MARGARINE	**JAM**	**BUTTER**	**JELLY**

Scopes

There are many devices called "scopes" that are used in science and technology. They permit the user to see things they otherwise wouldn't be able to see using only their senses. See if you can match the names of the scopes with their drawings.

1. **GYROSCOPE**
2. **HOROSCOPE**
3. **KALEIDOSCOPE**
4. **KINESCOPE**
5. **OSCILLOSCOPE**
6. **OTOSCOPE**
7. **PERISCOPE**
8. **SPECTROSCOPE**
9. **STEREOSCOPE**
10. **STETHOSCOPE**



"Surfing the net is not what I consider a physical activity."

A Fish Story

When the math teacher returned from his fishing trip, his students inquired as to the length of his prize catch.

The teacher answered, "The head measured 9", the tail was as long as the head and half the body, and the body was as long as the head and tail."

How long was the math teacher's prize fish?

Puzzle devised by David Pleacher, www.pleacher.com/mp/mpframe.html

See answers on page 49.

We pay $25 for brainteasers and puzzles and $20 for cartoons used on this page. Preferable theme for all submissions is career-technical and STEM education. Send contributions to vanessa@techdirections.com or mail to "More Than Fun," PO Box 8623, Ann Arbor, MI 48107-8623.

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"At the Commack Middle School, we take our technology education seriously. Five years ago, when we were considering modernizing our program, we looked to Techno for help. Together, we decided on a CAD/CAM/CNC package that included a Techno CNC Router. With these additions, we instantly transformed our department from 1950's technology, to the 21st century. We now have the ability to design digitally, convert those designs to language understood by our CNC, and machine projects with ease. We use our equipment to design and manufacture CO2 cars, cutting boards for our woodworking club, and extensively throughout our STEM elective.

With Techno's help, we transitioned our students quickly and easily. Most importantly, kids love the new technology. They understand the technology and how it can be applied to real world circumstances, are comfortable with the software, and enjoy the computer/machine interaction, so there is very little teacher "salesmanship" required to get a "buy-in" from all students."

— John Murphy, Lead Technology Teacher, Commack Middle School

Celebrate Black History Month!

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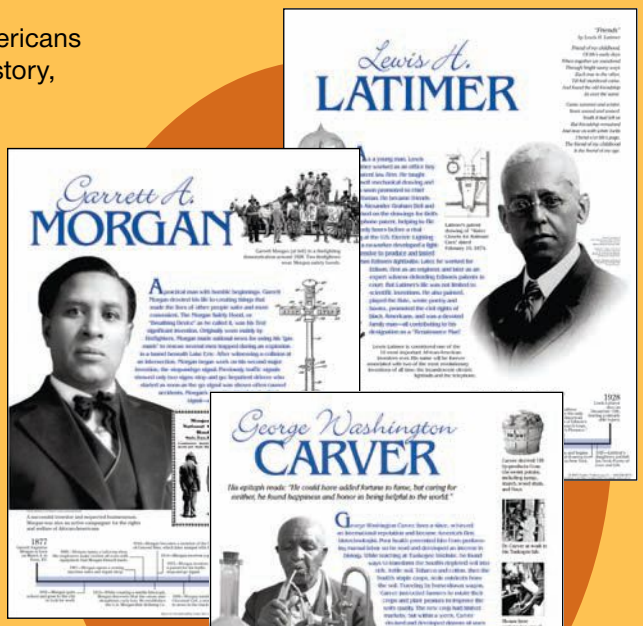
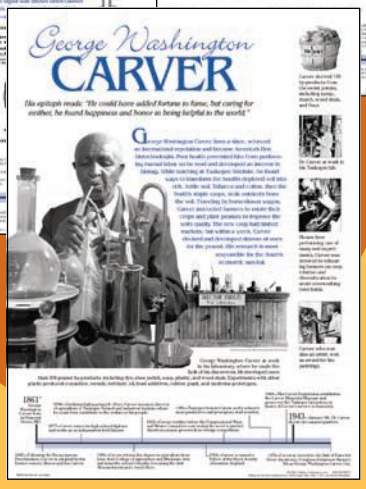
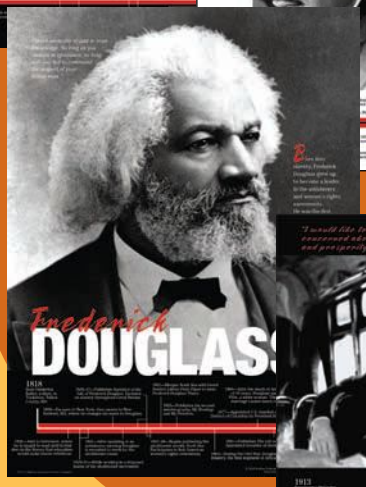




February is Black History Month



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