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DECEMBER 2018

Dealing with Digital Distraction

FREE PROJECT

Building a Bat Wing Glider

Annual
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Directory
Inside





Vanessa Revelli vanessa@techdirections.com

As we come to the end of another year, I wanted to take a moment to thank you, our loyal readers. Each month I get amazing feedback with your thoughts on the magazine, and information about what you are doing in your schools to teach our next generation of leaders. You really inspire me! Please continue to reach out. Your feedback helps guide the direction of Tech Directions, and I really do appreciate it.

There is some good news coming out of Washington D.C. that I wanted to share with you. In November, Senators Lamar Alexander (R-TN), Patty Murray (D-WA), Sheldon Whitehouse (D-RI), and Cory Gardner (R-CO) introduced the bipartisan "Faster Access to Federal Student Aid Act of 2018" (S. 3611), a bill that would, through better integration with the Department of Education and the Internal Revenue Service, simplify the application, verification, and student loan repayment processes. This bill takes the important step of amending both the Internal Revenue Code and Higher Education Act (HEA) to allow for cross-agency data-sharing that would improve the federal student aid system for students and borrowers. Complete information on the Act can be found at <https://www.congress.gov/bill/115th-congress/senate-bill/3611>

The bill would simplify the financial aid application process for students and families and streamline enrollment in and renewal of income-driven repayment plans for borrowers.

In addition, the bill would take meaningful steps to reduce verification burden, a process that remains overly complex, disproportionately affects low-income students,

and is burdensome for students and aid administrators. In October, NASFAA (National Association of Student Financial Aid Administrators) released an issue brief on verification calling on Congress to take action to address this issue. You can find the brief at http://www.nasfaa.org/issue_brief_verification.

"The FAFSA Act not only makes the application process easier for students, but also does so while preserving the integrity of the student aid programs," NASFAA President Justin Draeger said. "These are the sort of common-sense, bipartisan solutions students and families need from Washington, D.C., and we applaud these Senators for their commitment to removing barriers to a postsecondary education. The financial aid community urges swift action on this bill so that work can begin to reduce the application and data verification burden that continues to overwhelm students and institutions."

For more information on The FAFSA Act, see NASFAA's summary of the bill at <https://www.nasfaa.org/news-item/16761/Senators-Introduce-Bipartisan-Bill-to-Simplify-FAFSA-and-Reduce-Verification-through-ED-IRS-Data-Sharing>.

Vanessa Revelli

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A collection of leading suppliers of equipment, materials, and media for CTE and STEM education.

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Thank you to all the readers who found the mistakes in two of our November puzzles. Here are the corrected versions of each.

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About the cover: Many students find themselves distracted in class by their digital devices. See article on page 13. Cover design by Sharon K. Miller.

Vanessa Revelli

vanessa@techdirections.com

Perkins Act Renewed

In July, *The Strengthening Career and Technical Education for the 21st Century Act* was signed into law. This bill reauthorizes the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins) and will be referred to as Perkins V.

Perkins is dedicated to increasing learner access to high-quality Career Technical Education (CTE) programs of study. With a focus on systems alignment and program improvement, Perkins is critical to ensuring that programs are prepared to meet the ever-changing needs of learners and employers. Perkins reflects the 100-year federal commitment to CTE by providing federal support for CTE programs and focuses on improving the academic and technical achieve-

ment of CTE students, strengthening the connections between secondary and postsecondary education, and improving accountability. Perkins affords states and local communities the opportunity to implement a vision for CTE that uniquely supports the range of educational needs of students—exploration through career preparation—and balances those student needs with the current and emerging needs of the economy.

Resources on Perkins V

- Perkins V (September 2018)—Full text of Perkins V (*The Strengthening Career and Technical Education for the 21st Century Act*). https://cte.careertech.org/sites/default/files/PerkinsV_September2018.pdf

- Major Tenets of Perkins V (August 2018)—A one-page overview of the major tenets of *The Strengthening Career and Technical Education for the 21st Century Act* (Perkins V). https://cte.careertech.org/sites/default/files/PerkinsV_One-Page_082418.pdf

- Side-by-Side Analysis of Perkins IV and Perkins V (October 2018)—This document displays the text of Perkins IV alongside the text of Perkins V and includes an analysis of the changes between the two laws. https://cte.careertech.org/sites/default/files/PerkinsV_Side-by-Side_Draft_Updated101618.pdf

- Perkins Accountability Comparison (October 2018)—This document compares the secondary and postsecondary indicators of performance in Perkins IV and Perkins V, as well as points out alignment with performance measures from ESSA and WIOA. <https://cte.careertech.org/sites/>

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

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[default/files/AdvanceCTE_Perkins_Accountability_Comparison_October2018.pdf](#)

- **Coordinating Across Perkins V and the Workforce Innovation and Opportunity Act (October 2018)**—This guide from Advance CTE and the National Skills Coalition looks at six opportunities to promote coordination across Perkins V and the Workforce Innovation and Opportunity Act (WIOA) as states develop and implement plans under Perkins V. https://cte.careertech.org/sites/default/files/CoordinatingAcrossPerkinsV%26WIOA_102218.pdf

- **Perkins V Redline (August 2018)**—This document shows how the text of Perkins V compares to Perkins IV. https://cte.careertech.org/sites/default/files/PerkinsV_Redline_082018.pdf

- **Summary and Analysis of Perkins V (August 2018)**—An overview of Perkins V, including state and local implications. https://cte.careertech.org/sites/default/files/AdvanceCTE_ACTE_P.L.115-224Summary_Updated082218.pdf

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- **Understanding *The Strengthening Career and Technical Education for the 21st Century Act* (Perkins V) (August 2018)**—An overview of Perkins including its purpose, how funds are distributed, and why Perkins is an investment that matters. https://cte.careertech.org/sites/default/files/AdvanceCTE_ACTE_P.L.115-224Summary_Updated082218.pdf

- **Advance CTE and ACTE Joint Letter on Senate Passage of Perkins Reauthorization (July 2018)**—A letter to the Senate in response to the Perkins Reauthorization Bill that the Senate voted to pass on July 23, 2018. https://cte.careertech.org/sites/default/files/ACTE-Advance%20CTE_Letter%20to%20Senate_072318_final.pdf

Resources on Perkins IV

- **Carl D. Perkins Career and Technical Education Act of 2006** (January 2006)—Full text of Perkins IV. http://s3.amazonaws.com/PCRN/docs/perkins_iv.pdf

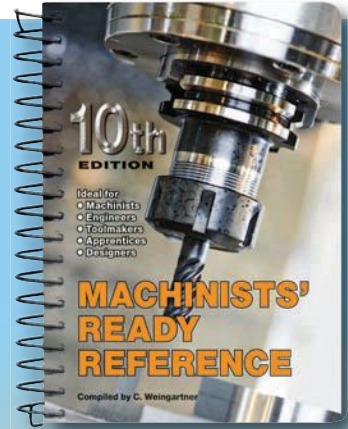
- **Recommendations for Perkins**

Reauthorization (February 2016)—A summary of Advance CTE's recommendations for the renewal of Perkins. https://cte.careertech.org/sites/default/files/Advance_CTE_Perkins_Recommendations_2018.pdf

- **How States Use Perkins—The Basics (October 2017)**—A summary of the ways states leverage Perkins to support CTE. https://cte.careertech.org/sites/default/files/How_States_Use_Perkins-The_Basics-2017Update.pdf

- **Perkins Collaborative Resource Network**—The U.S. Department of Education's Office of Career, Technical and Adult Education Division of Academic and Technical Education website with information on Perkins, including non-regulatory guidance, state profiles, performance data, and more. <https://cte.ed.gov/>

- **Carl D. Perkins Career and Technical Education Act of 2006: Background and Performance (December 2012)**—A Congressional Research Service report for Congress on outcomes under Perkins. <https://fas.org/sgp/crs/misc/R42863.pdf>



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Wood that Is as Tough, Hard, and Strong as Steel

It seems like yesterday that I was teaching students about soft and hard woods. How the trees that they came from, that are classified by their type of leaves, determined the wood's basic hardness and other characteristics. The wood that I am

and Dr. Teng Li are the material science and engineering professors that led the team that turned common wood into a material that is as strong as steel.

My statement on the properties of this processed wood seems so outrageous that I feel it necessary to quote the opening sentence of the UMD news release (<http://snip.li/D89k>) that heralded their material science breakthrough: "Engineers at the University of Maryland have found a way to make wood more than ten times stronger and tougher than before, creating a natural substance that is stronger than many titanium alloys." Photo 1 shows a piece of their densification processed wood stopping a bullet that would normally go through wood as if it

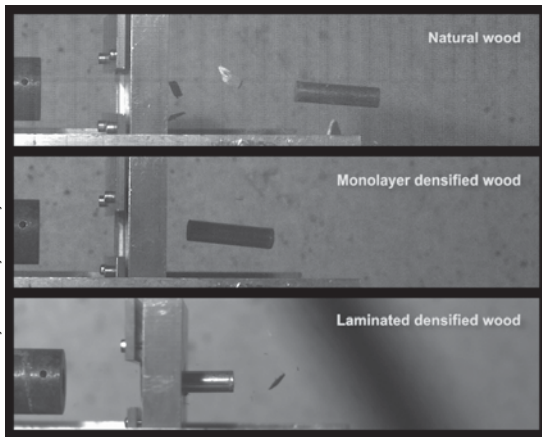
walls that nature has learned how to build by combining hemicellulose and cellulose fibers. The wood has a third chemical ingredient called lignin, in and between these hard-walled cells, that acts as a natural glue and gives the wood its ability to resist compression. It is the combination of these three ingredients that gives wood its structure, hardness, and has made wood the perfect building material for thousands of years.

To compress the wood using their densification process, the scientific team determined that it was necessary to remove most of the hemicellulose fibers that increase the stiffness of the cell walls and remove most of the lignin that prevents the compression of the cells. The researchers theorized that once these two ingredients were removed the wood wouldn't resist compression.

The goal of their research was to find a way to leave the cellulose structure of the wood alone while reducing the other two natural wood ingredients that naturally resisted densification. Photos 2 and 3 show the wood's structure under a microscope before and after densification.

The first step of their process uses the same boiling bath and chemicals that are used to make paper. The major difference in this

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



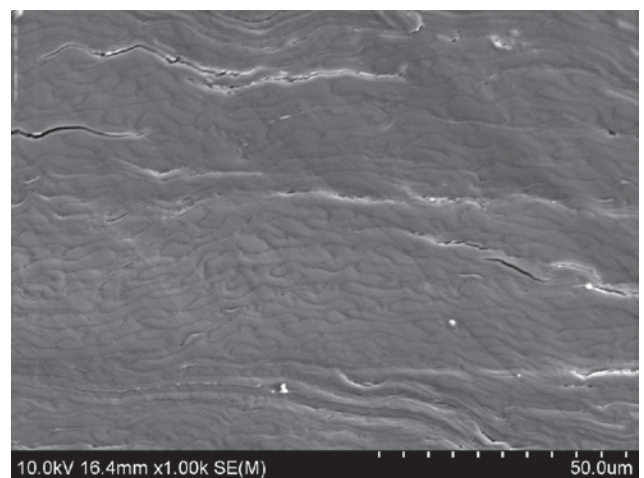
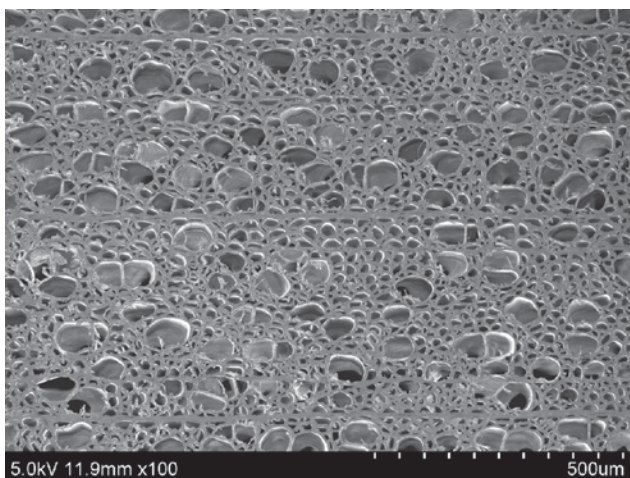
Photos courtesy University of Maryland

Photo 1—In the movies, just about everything can stop a high-speed bullet. In reality, a bullet will penetrate undensified lumber without much loss of velocity.

going to describe left the forest as a soft or hard wood and gained its new properties in a lab at the University of Maryland (UMD). Dr. Liangbing Hu

was going through paper.

To understand their densification process, you need to know that wood, like all plants, has hard cell



Photos 2 & 3—Wood cells, under magnification, before (left) and after the densification process.

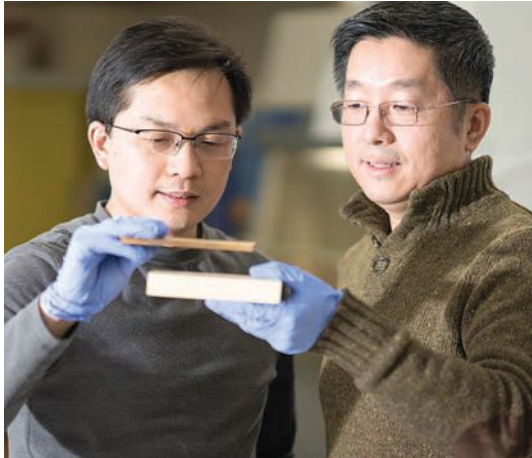


Photo 4—Dr. Liangbing Hu and Dr. Teng Li are holding wood that was once the same thickness. The thinner one was reduced in thickness by their densification process.

first step between the paper making process and their densification process is the wood. In their process, it's being treated as a solid board rather than wood chips.

The next step is to warm the wood and place it in a press to subject it to extremely high compres-

sion to squish the wood cells in the board, so they are approximately one fifth of their natural cell size (Photo 4). The team determined that the pressure treatment causes all the atoms in the wood to form hydrogen bonds. A wood finish was used to prevent the wood from absorbing moisture during some of the testing. The result is a piece of wood that is as tough, hard, and strong as steel.

Taking it a Step Further

Wood that has all the characteristics of steel could enter the world of manufacturing, construction, art, and home crafts in so many ways.

1. What do you think will be the first commercial use for densified wood?
2. Why would this wood be labeled as a renewable resource? 🌱

Puzzle corrections Answers

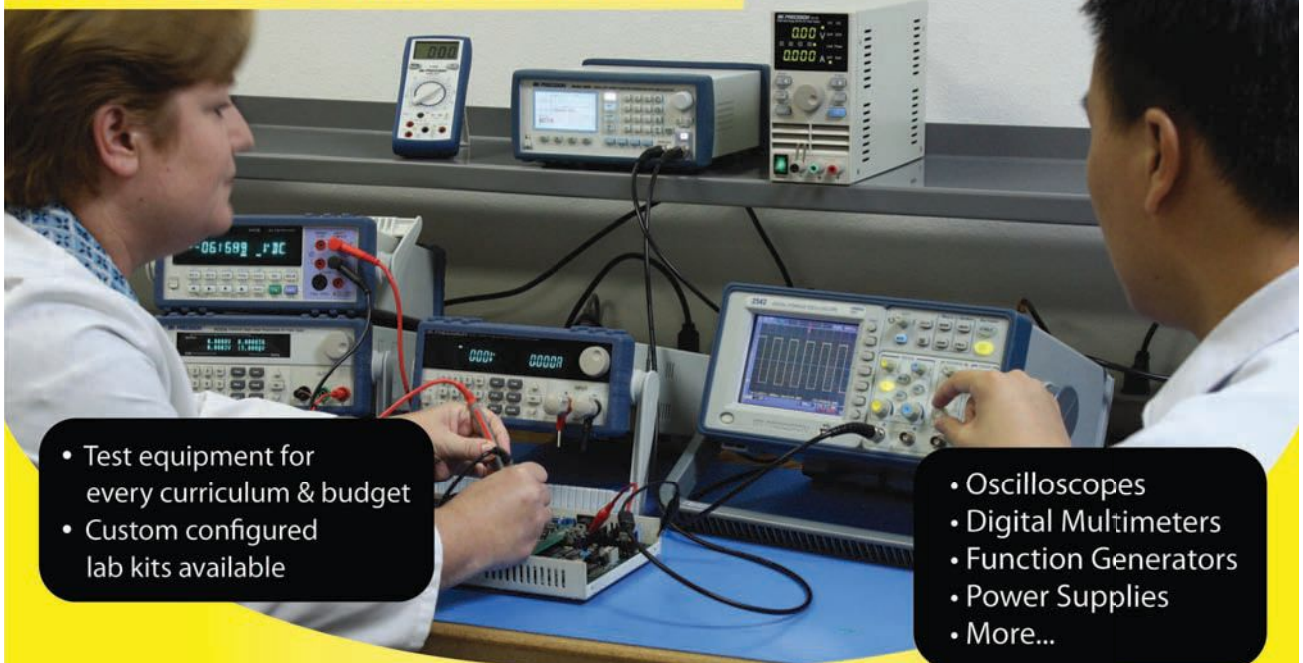
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A. V. Roe and His Avro Airplanes

The family names of some early airplane manufacturers occasionally appeared in their airplane model names. An example is the World War I Sopwith Camel, built at a company founded by Thomas Sopwith. One aircraft pioneer went a step further and included his initials. His 1913 Avro 504 was a popular trainer for over 20 years. Alliott Verdon Roe established the A.V. Roe Aircraft Company in Manchester, England, in 1910.

Roe was born in Manchester in 1877 and raised with six siblings.



Alliott Verdon Roe

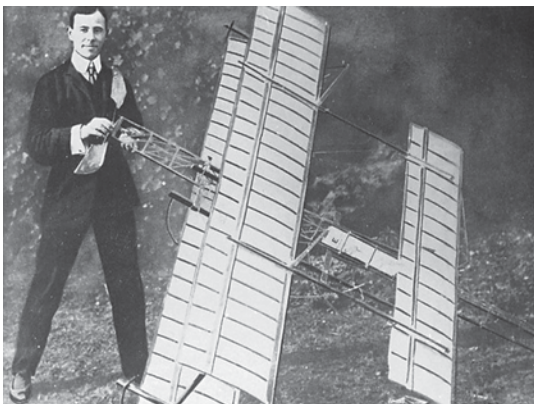
later, he was helping operate steam engines on British Merchant Marine ships. While resting between sea voyages, Roe made large model airplanes. He corresponded with Orville and Wilbur Wright shortly after their historic 1903 flight at Kitty Hawk, NC.

Roe read what he could on aviation and entered his first model airplane event in 1907. His rubber band-powered biplane had an 8' wing span and flew over 100'. He won the £75 first prize. It helped convince one of his brothers to provide him with

constructed a biplane in his spare time and successfully flew it over short flights in 1908. The aircraft used a borrowed 24 hp French Antoinette engine. This was the first time a British citizen made a powered flight, on British soil, and in a British-built airplane. Roe and his brother formed a partnership in 1910. It was the world's first airplane-manufacturing company. He earned his flight license that year and also married Mildred Kirk. They had nine children.

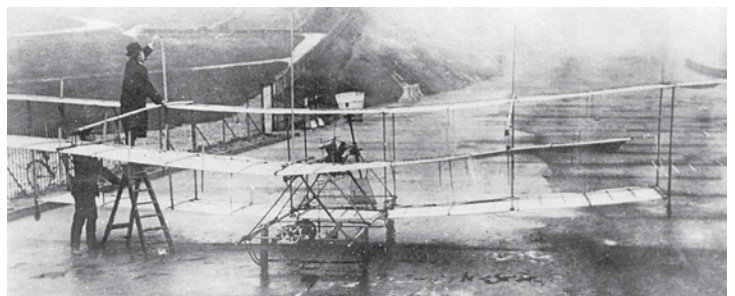
Roe initially constructed experimental triplanes that used various engines. He flew his Roe I Triplane in 1909 but damaged it that year in a flight accident. He built three more models, which he named Roe II (in 1909), III (in 1910), and IV (in 1910). None have survived the years, but aircraft enthusiasts have constructed replicas.

Roe fitted an airplane with floats in his small workshop and flew the first British seaplane. Roe constructed a prototype monoplane in 1912 with the first enclosed cabin. Named Avro F, it had a 35 hp Italian Viale engine. A modified version



His father was a physician and his mother worked at establishing nursery day care standards. He had a comfortable middle-class lifestyle, and his father expected Roe to also become a physician. But Roe had developed an interest in technical topics and became a railway locomotive apprentice at 16. A few years

Dennis Karwatka is professor emeritus, Department of Applied Engineering and Technology, Morehead (KY) State University.



Far left, Roe with his model airplane that won an event in 1907. Above, workers assemble a Roe 1 triplane on an automobile race course.



Left, a 1909 Roe I triplane

garage space to build a full-size airplane. Roe also had to earn a living and worked as a drafter for a division of Simplex Motor Car Company. He

established a flight duration record of 7-1/2 hours.

Roe built a variety of limited production airplanes before designing

An Avro F (1912), which featured the first enclosed cabin



An Avro 504

his Avro 504 in 1913. It was a two-seat biplane intended to be used as a fighter-bomber during World War I. It fulfilled those roles, but the rugged aircraft was more useful as a trainer. Initially powered by an 80 hp, 7 cylinder French Gnome rotary engine, over 10,000 were built in Manchester through 1932. Practically all British pilots of the era trained on Avro 504s.

Another successful design was the Avro Avian for the civilian market. It used a 70 hp Armstrong-Siddeley Genet engine; over 400 were constructed between 1926 and 1928.

Roe lost control of his company in 1928 and sold his shares. He and his brother joined with another com-

pany to form Saunders-Roe Ltd. near Portsmouth. Also known as Saro, the company emphasized flying boats. But their products did not have the staying power of the Avro 504. Saro has merged several times with a variety of others. Roe's original aircraft company went out of business in 1963. He died in 1958. ©

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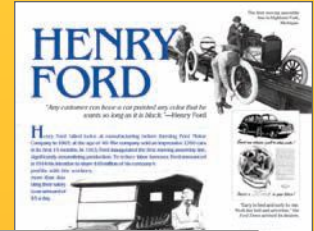


An Avro Avian

A 1930 Saro seaplane



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Dealing with Digital Distraction

Solutions run the gamut—
from tech breaks to tech take-overs.

By Chris Berdik

“FIFTEEN minutes!” Toddy Eames announced, calling a break in her three-hour screenwriting class. Her students stood, stretched, or ambled to the door. “You can take out your phones,” she added, but most students were already scrolling through the texts, emails, snapchats, and other postings that had piled up during an hour of mandated tech abstinence.

Since fall 2016, the communications department at Dominguez Hills has banned smartphones, laptops, and other personal technology in every classroom—with grade deductions for violations—except for teacher-guided use and “tech breaks” during longer classes such as Eames’s.

The policy was spearheaded by the department chair, Nancy Cheever, who is part of a team at the university investigating digital distraction, an issue that, for many teachers, has graduated from a nuisance into a serious threat to learning.

In K-12 and college classrooms across the country, some educators are enacting at least partial device bans, some are advocating for teaching style changes (fewer lectures, for example), and still others are seek-

ing help from the technology itself. There’s little consensus, except that the peril of digital distraction neither starts nor ends in school, and learning to tame our tech obsession is a new and vital life skill.

Divided Minds

The distraction researchers at Dominguez Hills—Cheever, and psy-

chologists Larry Rosen and Mark Carrier—are digging deeper into compulsive tech use. They want to see how constant alerts and phone checks register in our brains, what thoughts or emotions trigger the

distractions, and what might keep them at bay. It’s not just young people who are smartphone obsessed. Between 2011 and 2017, the percentage of American adults who own a smartphone more than doubled, to 77%, according to the Pew Research Center. All that mobile computing has turned us into a nation of multitaskers who do



Students in a marketing course at Roger Williams University in Rhode Island check their phones before class begins. To tame classroom distraction, their professor uses Flipd, an app that locks students out of their phones during class.

nearly everything while gazing at one or more screens.

The difference between today’s students and older generations, according to the Dominguez Hills team, is that younger people are more confident in their ability to multitask and do it more often.

But true multitasking is a myth. Our brains focus on one thing by shutting out others. We can’t pay attention to two things simultaneously, such as reading a text string while listening to a teacher’s instructions.

Chris Berdik is a science journalist who has written about the intersection of science with ethical issues and the peculiarities of the human brain. Condensed, with permission, from a January 22, 2018, post on The Hechinger Report, a nonprofit news organization focused on inequality and innovation in education, in partnership with the Huffington Post. To read the entire post, visit www.hechingerreport.org. Condensation appeared in the September 2018 issue of The Education Digest, www.eddigest.com

Inevitably, something gets missed. Plus, rapid attention-switching exacts its own cognitive penalties.

A growing pile of studies finds that the more students multitask, the lower their grades. And multitasking is nearly constant. A few years ago, the Dominguez Hills researchers watched hundreds of middle school, high school, and university students as they studied. The students stayed with a single task for less than six minutes on average before switching to something else. Rosen gave statistics about his students' smartphone use, which he'd tracked with an app (with their permission) for two years: Average daily phone use jumped from 3 hours and 40 minutes in 2016 to 4 hours and 22 minutes in 2017.

But true multitasking is a myth. Our brains focus on one thing by shutting out others.

"My guess is it will go to 5 hours plus. It'll get worse before it gets better," said Rosen, who co-authored *The Distracted Mind* (2016) with Adam Gazzaley, a neuroscientist at the University of California, San Francisco. "This thing isn't a tool," he said, holding up his phone. "It's an appendage."

To Ban, or Not to Ban

Constant checking of mobile devices has triggered a wavelet of classroom technology bans, especially at the college level. For instance, in 2017, after two separate studies at West Point found that students who used laptops in class received poorer grades, the lead researchers of the studies banned computers from their classrooms.

"I've had about 20 or 30 people reach out to me and say, 'I just read your paper and now I've stopped allowing laptops in the classroom,'" said one of the authors, economics professor Richard Patterson. However, many educators are adamant that the answer to digital distraction isn't to ban devices, but to adjust

how teachers teach in light of technology's omnipresence.

"If you're lecturing, your odds going up against Facebook, the Victoria's Secret catalog, or an online game are slim," said Deborah Heitner, author of *Screenwise: Helping Kids Thrive (and Survive) in Their Digital World*. She argues for more direct dialog with young people about technology and the need to learn how to manage its use throughout their lives.

Likewise, the nonprofit Common Sense Education uses the slogan "Don't Make a Ban Have a Plan" in its online toolkit for fighting digital distraction. The toolkit includes suggestions for meaningful things students can do with their devices—from classroom polling and quiz apps to digital creation tools—and advice for setting boundaries with a "Customizable Device Contract."

In the end, the technology-ban divide is often more a question of degree than of absolutes. Most ban advocates make room for exceptions, whether for students with disabilities or for directed use of technology in class, while ban opponents typically advocate for clear boundaries, including tech-free time and consequences for device misuse.

Hoping to strike the right balance, many educators have sought help from the technology itself. In fall 2016, for instance, the Lackland Independent School District outside San Antonio, TX, purchased a "mobile device management" system called TabPilot that gives teachers a dashboard view of each student's school-issued iPad—and the power to take control and snap the browser of every device to a specific app or website.

"Before, it was wack-a-mole," said Lesley Wreyford, the instructional technologist at Lackland's Virginia Allred Stacey Junior-Senior High School. "Kids can be really creative in bypassing filters."

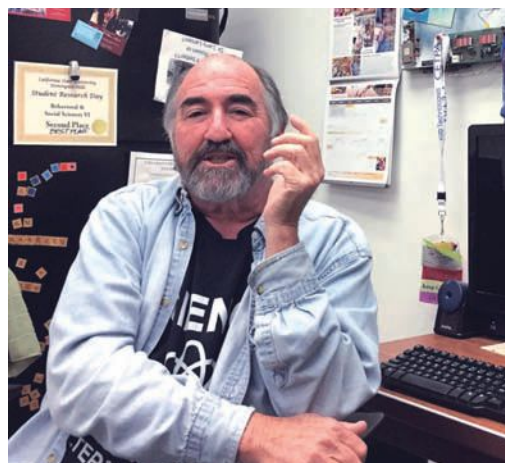
Meanwhile, at Rhode Island's

Roger Williams University, marketing students have installed an app called Flipd that shuts down their smartphones during class—with compli-

In data collected by Cal State Dominguez Hills' psychologist Larry Rosen, his students' average daily phone use jumped from 3 hours and 40 minutes in 2016 to 4 hours and 22 minutes in 2017.

ance trackable by their professor, Edward Gonsalvez, and factored into their participation grades.

During a recent meeting of Gonsalvez's class, the visible smartphones were dutifully dark and quietly charging from floor outlets. But most students still had laptops with several webpages open as the class discussed Facebook's newsfeed algorithm and promotional plans



Larry Rosen, psychology professor, is part of a team at Cal State Dominguez Hills using behavioral studies, physiological stress measures and brain scans to investigate how the distraction and anxiety engendered by digital devices can hurt learning.

for small businesses that wanted to boost social media traffic. By and large, students were engaged, but many still checked email and other on-screen interests.

After class, Gonsalvez was matter of act. He deemed the laptops too useful to banish, but acknowledged their potential for distracting students. “I can tell when they’re engaged or not, just by their body



Jonathon Rodriguez, a graduate student in English at Cal State Dominguez Hills, says he cut way back on his phone use after he decided to “take school more seriously.”

language,” he said. “I try to treat them as adults. And they can sink or swim as adults.”

I Phone, Therefore I Am

During the pause in the Dominguez Hills screenwriting class, student Miroslava Cerda stayed at her desk near the front and scanned texts. Noting the messaging and social media alerts swamping her phone, she said, “Sometimes, it just gets too much, and I’m like, ‘Ugh! I need a break.’”

Still, she admitted the allure of the connectivity. Even with a classroom technology ban, she said, “sometimes, I still want to sneak a peek.” There’s growing evidence that mobile devices can hijack our minds even when we’re not scrolling. A 2017 study in the *Journal of the Association for Consumer Research* found that student subjects who kept their smartphones on their desks (face down and on silent), rather than in a backpack or stashed in another room, performed worse on tests of attention and cognitive processing. The difference was biggest

among students who reported being the most attached to their smartphones.

What gives these devices such a strong hold on us? A prime suspect is a form of anxiety, commonly known as FOMO “Fear of Missing Out”—a term that originated in the early 2000s at Harvard Business School to describe grad students’ frantic, text-driven social lives. Social media supercharged FOMO, and the term was popularized by MIT psychologist and sociologist Sherry Turkle in her 2011 book, *Alone Together*.



Prompted by her research and classroom observations, Nancy Cheever, chair of the communications department at Cal State Dominguez Hills, championed a department-wide ban on laptops and mobile devices in class in 2016.

“Basically, we all walk around needing to know who wants us, and who’s calling out for us,” said Turkle. “So the norm is that you’re always on.”

The Dominguez Hills researchers are exploring a distilled version of this anxiety—a sense of dread when separated from our virtual social networks, comparable to the jitters of an addict in early withdrawal.

The depth of the anxiety correlates with the extent of a person’s smartphone use, according to a 2014 study led by Cheever. Undergraduate subjects, rated as light, medium, or

heavy users of mobile devices, based on survey responses, were deprived of their smartphones for more than an hour and reported their anxiety levels at regular intervals. The anxiety felt by the light users stayed steady for the duration of the study, while the anxiety of heavy users shot through the roof as phoneless time continued.

The possibility that such anxiety can gum up our mental works as much as the occasional Facebook foray is the rationale for the “tech breaks” in Cheever’s department. “What helps with the anxiety is if you tell them, ‘OK, for this amount of time, you’re not going to look at your phone, but then you’ll get to check in again,’” she said. The goal is to wean the brain off its need to constantly check in, by relieving the anxiety that drives the compulsion.

Back at the screenwriting course, however, the direction of society’s technological tide was clear. Smartphones appeared in every story workshopped—sometimes nearly as prominently as the characters themselves.

At one point, Eames led a class discussion about how best to write instant-message dialog. A few students zoned out occasionally, but nobody stared into a screen. One student stood out due to his dress slacks and a tie clipped neatly to an button-down. More distinctive still was the fact that during the tech breaks, this student, Jonathon Rodriguez, reached for a book rather than his phone. That evening, he immersed himself in *Story*, the class textbook on screenwriting by Robert McKee.

“It’s part of my decision to take school more seriously,” said Rodriguez, a first-year master’s student in English. He offered a philosophical reflection on why we have such a hard time avoiding our screens.

“It really isn’t that hard, but people have all these insecurities,” he said. “They can have actual, intelligent conversations with real people in class. But, the fact that they’re not getting likes on Instagram or Facebook tells them they’re not liked or appreciated by the world.”



Careers in Construction Building a Talent Pipeline

Is going to a traditional four-year academic university the only true path for success? To definitively answer that, we have to first understand what success looks like and how we measure it. Merriam-Webster defines success as a “favorable or desired outcome,” as well as the “attainment of wealth or favor.” By this definition, success would be dependent on what we ourselves see as desired or favorable. Are we considering only monetary value or the work-life balance that connects us with family? What do we measure as favorable—a high salary, job security, being able to work with our hands?

Many of us want to know we’re supporting our families to the best of our abilities while doing something we find meaningful. Knowing the company we work for is making some sort of difference in the world—taking pride in what we’re doing—is important. In addition, the security a good job with benefits can bring is significant.

But how are we approaching the idea of achieving success with our children or with students? Are we implying the only way to succeed is through a four-year university degree? That, unless they receive scholarships which help soften the cost incurred by going to college, even a public university, the only path to success is one down a road filled with debt and possibly even a struggle to find gainful employment. As Tim Johnson, founder and president of the TJC Group stated, “Today

Article courtesy of <https://www.constructiondive.com/news/careers-in-construction-building-a-talent-pipeline/533417> and sponsored by NCCER.

we know that 70% of the jobs that exist in the U.S. economy require something less than a four-year college degree.” Is a four-year academic degree the right path for some people? Yes, of course! Is it the only path to success? Absolutely not!

“I’m not sure who predetermined that success meant that you had to go to a four-year college in order to find opportunities, but that could not be

“I’m not sure who predetermined that success meant that you had to go to a four-year college in order to find opportunities, but that could not be further from the truth.”

further from the truth,” shares Jennifer Wilkerson, director of marketing at NCCER. “We have to start thinking about success in a whole new way and talk about the many opportunities in construction.”

Starting these conversations about the benefits of a career in construction are crucial to the recruitment of the next generation of craft professionals, especially with 80% of contractors reporting difficulty in finding hourly skilled workers. We are lacking the trained professionals needed to build our infrastructure and projects and have lost our edge as an innovative, progressive country because at the beginning of everything is construction—from the roof over our heads to the roads we travel.

Starting the Conversation

How do we regain the progress we’ve lost? As “Restoring the Dignity of Work: Transforming the U.S. Workforce Development System into a World Leader” points out, one of the first changes we can implement is to “communicate all career paths to students in secondary education and their parents.” Career paths include a wide variety of options, including career and technical education (CTE), technical schools, and work-based learning programs such as apprenticeships. Tommy Collins, who entered the industry as a pipefitter and is now the chief operating office of S&B Engineers and Constructors, states, “The construction industry has always been a gateway to limitless professional opportunity for anyone who wants to work hard and commit themselves to lifelong learning and self-improvement—anyone. I know because I’ve walked the walk myself.”

To jumpstart this communication, many states throughout the U.S. celebrated October as Careers in Construction Month, spearheaded by NCCER’s Build Your Future (BYF) initiative. This month-long celebration began with representatives from each state requesting their governor proclaim October as Careers in Construction Month (CICM) and continued with career days, recognition of craft professionals, and more.

CICM is the perfect way to kick off a discussion about what success looks like, and the many ways to achieve it. In addition, BYF provides resources for educators and industry representatives, including how-to guides, infographics, posters, craft trading cards, and more, to help each state spread awareness of opportunities within the industry.

The benefit of celebrating CICM is immense—from the impact of how many states proclaim to the students learning about construction at career days to the sheer publicity of uniting as a nation to recognize craft professionals. However, we should use the momentum to continue the discussion about the opportunities available in the industry and support the programs that are training the next generation of skilled workers. With the time needed to become fully trained, we must show students the merits of careers in construction and the value of choosing a career path that provides high salaries, growth opportunities, and meaningful work.

In fact, the value of craftsmanship and diverse opportunities available in the industry is recognized in an exciting film, “Good Work: Masters of Building Arts,” recently released on PBS. Directed by Academy Award-winning filmmakers Marjorie Hunt and Paul Wagner and co-produced with the Smithsonian Institution Center for Folklife and Cultural Heritage, Good Work honors American craftsmanship and the men and women working behind the scenes to bring enduring beauty to the built environment.

“Craftsmanship is defined as ‘the beautiful or impressive quality of something that has been made using a lot of skill’. Construction craft professionals exhibit this routinely and every member of our society benefits from this in almost all aspects of their daily life. However, over the past few decades, our society has steadily undervalued their skills and contributions to our built environment,” says Don Whyte, chief executive officer of NCCER. “We must recapture the dignity of work as well as the pride and honor inherent in skilled occupations. As the construction industry builds the world, it must also polish its image and hold all workers in high regard.”

Connecting Industry to Education

As we continue showing students and parents the value of choosing construction, there are multiple ways industry can become involved in building a talent pipeline to the workforce. From volunteering on advisory boards

to working directly with schools to offering hands-on training, companies are connecting with education across the nation.

Determined to make an impact on the skilled workforce shortages facing the construction industry in Virginia, a new partnership has been formed by the Virginia chapters of Associated General Contractors (AGCVA) and Associated Builders and Contractors (ABCVA) in conjunction with BYF to be a catalyst for recruiting the next generation of craft professionals. Providing details about salaries in construction, training available in Virginia, and companies hiring, BYF Virginia represents a lifeline for parents, teachers, school counselors, and students thinking about their future. Designed to help students who are looking into options beyond the traditional university track, this resource highlights pathways to find meaningful, good-paying positions in the construction industry through work-based learning, certifications, and credentials.

Northwest Arkansas Community College’s Mobile Construction Labs, equipped with various tools, safety equipment, and generators, are engaging students by traveling to various secondary schools. Dawn Stewart, the district’s career and technical education director explains, “It’s not only for career exploration but also those hands-on learning experiences related to construction.” From carpentry to welding, young people are being introduced to new crafts and able to earn NCCER industry-recognized credentials. “It gives students a head start in the workforce,” points out Cori Miller, project Manager with Crossland Construction, “and it gives employers more knowledgeable and invested apprentices.”

Wayne J. Griffin Electric (Griffin Electric) took their apprenticeship program to the next level by partnering with Wentworth Institute of Technology to incorporate technical skills and hands-on, practical education. Graduates of Griffin Electric’s Apprenticeship Training Program have the chance to pursue an Associate of Applied Science degree in Engineering and Technology (AENT). For both Wentworth and Griffin Electric, this partnership presents

a rewarding opportunity to share curriculum, deliver in-house training to Griffin employees, and assist them in the goal of becoming future leaders within the electrical industry.

These organizations, and others like them, are showing it’s possible to make changes now that are necessary for our continued growth as a country. Not only does construction afford us ease of life and convenience, but it also offers occupations that have been overlooked for far too long. We have encouraged our children to attend traditional academic college paths as the only way to find fulfillment and financial freedom to their detriment—and ours.

From secondary to postsecondary students, organizations are providing an introduction to the industry, the ability to earn credentials, or the chance to be an apprentice—all



“We have to start thinking about success in a whole new way and talk about the many opportunities in construction.”

demonstrating that success is not measured only by a four-year degree. Students are seeing for themselves the skills that go into working in construction and what their jobs could be—and hands-on experience is one of the best ways to learn more about any subject. Through industry and education working together, we can begin rebuilding the workforce with skilled craft professionals and highlight construction as a career of choice. ©

Taking to the Skies

STEM Club Students Help Restore Wings of Hope Airplane

By Tom Farmer
tfarmer@pitsco.com

CHARLES Richardson has taught thousands of students during his 17 years facilitating Pitsco Education STEM labs, the last six years in Lancaster ISD south of Dallas. And he's diligently explained

them ready. And if a kid thinks they can do something, guess what they do? They go and do it," Richardson said. "It's the same when we take them to competitions. We go to TSA (Technology Student Association). We go to Texas Alliance of Minority

2 p.m. for several months, a large group of STEM club members, under the watchful eyes of teachers and aircraft mechanics, worked on a Cessna 182 single-engine airplane at Lancaster Regional Airport.

"The kids took it all apart to get it ready to be refurbished. The engine was sent off to the engine shop," Richardson said. "Then when it came back, they put it all back together—wings and everything—to make it flight ready."



A dedicated group of Lancaster (TX) ISD STEM Club members spent a string of Saturdays working under the tutelage of teachers and aircraft mechanics, helping to restore a Wings of Hope airplane at the local airport.

to all his students how the labs can ignite a spark that eventually burns a trail to a satisfying and successful career.

But it's up to them to seize that opportunity as they explore and experience careers through hands-on activities.

"The lab is like a slingshot—it gets

Tom Farmer is communications manager, Pitsco Education, Pittsburg, KS.

Engineers. We do the National Society of Black Engineers. The reason I've taught this long is because I believe in the labs."

The Lancaster labs led to the creation of a STEM club for students in grades six and up. That group recently parlayed their hands-on skills into a project restoring an airplane used in Wings of Hope humanitarian missions (<https://wingsofhope.ngo/>).

Every Saturday from 10 a.m. to

Memorable—and Valuable—Experience

Not only did all students gain practical experience, but the females were able to disprove the preconceived notion that STEM and engineering are primarily a male's domain.

"It made me understand that this is not as hard as people made it to be for girls to do something like this," said Jaycee, a 10th grader. "You just have to get out there and try to learn it. It was like a once-in-a-lifetime thing because we got to do this through the school."

Jaycee's classmate Elizabeth chimed in, "It really does not matter if you are a girl or a guy, you are still a person. If you want to be a mechanical engineer, building planes or working on cars, you can do it."

Lancaster ISD's Executive Director of Academics and Innovation, Kyndra Johnson, said the labs have been key to opening the eyes of female and male students alike to the career possibilities that lie ahead. "Authentic learning activities in STEM subjects, coupled with

STEM Club students get the ultimate hands-on experience—the chance to work on a four-seat Cessna 182 single-engine airplane.



Spending time with professional aircraft mechanics helps build students' confidence, according to Lancaster ISD STEM Club sponsor Charles Richardson.

students' matriculation through our STEM labs is significantly important, not only in projects such as our recent aircraft build, but also in their future pursuits beyond graduation."

The Lab Advantage

Richardson's first foray with Pitsco was a Modules lab at the middle level, and for the past several years he has headed up a lab course titled Principles of Applied Engineering at Lancaster High School. The airplane restoration is the type of real-world project students need after they've had their STEM appetite whetted..

"I call this 'bridging to the future.' Let's go try this out. Let's do an

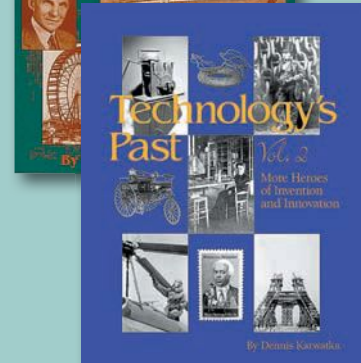
airplane project," Richardson said. "The confidence factor, knowing that they can achieve, communicate, collaborate, problem solve, and think critically—you don't gain that just anywhere. With the lab, you have an advantage. These labs are where kids gain the skills and abilities and knowledge to use their minds and their hands so when you take them outside the curriculum, they can do those kinds of projects."

The STEM club's success has even made it cool for students to be academically oriented, Richardson said. "You get all this working together, and then you have STEM kids running around the halls." 🎧



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Worker Shortage Spurs Uncharacteristic Partnerships Connecting Colleges, Business

One state tries to close the odd divide between what students learn and employers need

By Jon Marcus

DAVID Andy went to college after graduating from high school, spent his first two semesters drifting through introductory classes, then was told to pick a major.

That was when he had an unfortunate epiphany—he had no idea what he was doing there.

“I just didn’t like anything,” said Andy. “Nothing stood out to me.” He didn’t know what he’d do in real life with, say, a degree in English. “There was no end goal for that.”

So he quit school and went to work at a factory, rising up the ranks to journeyman. Before long, he was running two departments. Then he hit another roadblock.

“I couldn’t go any higher,” he said. “I needed a degree.”

Now Andy, who is 29, is enrolled in an unusual program at Metropolitan State University in Denver designed precisely to provide him with the degree he needs for a career in advanced manufacturing.

That’s because it brings the university together with employers in a building so new that construction workers still are putting the finish-

ing touches on labs crammed with equipment recommended and often contributed by industry partners, whose corporate logos cover the walls.

they’re turning away business because they can’t find workers with the right skills—has become a test case for ways to close that gap.

It’s using labor-market data from

David Andy, who is enrolled in a program in advanced manufacturing at Metro State University in Denver designed in collaboration with employers.



Photos: Jake Holschuh for The Hechinger Report

The \$60 million collaboration is meant to help solve the confounding disconnect between what colleges

sources such as LinkedIn to track and share what skills are in the most demand in a fast-changing economy.

It’s pushing apprenticeships for students who are still in high school, giving them experience not only on state-of-the-art automated factory floors but in the offices of banks and insurance companies.

It’s encouraging employers to come up with detailed job descriptions, rather than just listing the credentials they want applicants to have—credentials such as bachelor’s degrees that have often proved poor measures of whether workers are career-ready.

And it’s brought together businesses with universities to connect those degrees more directly with what students need to know for work.

If he had seen this kind of payoff

Colorado, where the unemployment rate is 2.7% and employers say they can’t find trained workers, has become a test case for ways to close the skills gap.

teach and what graduates need to know to fill jobs that are sitting empty in some of the nation’s fastest-growing industries.

And Colorado—where the unemployment rate is 2.7%, third-lowest in the country, and employers say

Jon Marcus is higher-education editor, 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.

to a university degree, said Andy, "I wouldn't have bailed" on his first try at a higher education.

The fact that it's unusual for universities to think about their graduates' employability may come as a forehead-slapping surprise to students. But while these conversations have occasionally happened among community colleges and neighboring businesses or when public institutions are prodded by lawmakers, they're only now beginning to occur on a scale as large as what's happening in Colorado, driven by frustration on all sides.

"For so long we've used a degree as a proxy for employability, but it doesn't work that way anymore," said Noel Ginsburg, CEO of a plastics and medical-equipment manufacturing company and founder of a statewide apprenticeship and job-training program called CareerWise Colorado. "Education changes slowly and what's happening out here in a factory or in an office is moving at the speed of light."

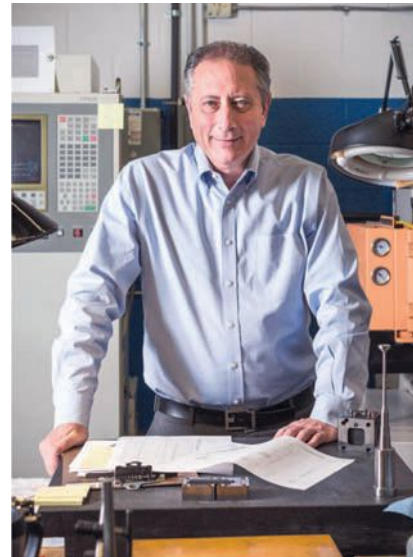
That has driven technology com-

panies such as Microsoft to create their own online courses in data and computer science, impatient with the pace at which universities and colleges can do it.

Now a Democratic candidate for governor running largely on a platform of training a skilled workforce, Ginsburg said he once asked an administrator at a public university why it wasn't trying to compete with high-priced, wildly popular so-called bootcamps that teach people how to code.

"He buried his head in his hands and said, 'The culture is, we don't really think in those terms.'" It would take two years for his university to set up a program like that, the administrator told him, and "by that time, the codes have changed. They never can catch up. It's a cultural thing in education where you have a process that worked in the 1930s but it doesn't work today."

This complaint is getting less and less pushback these days from universities and colleges. Contending with a punishing decline in enrollment and growing public skepticism



Noel Ginsburg at the plastics and medical-equipment manufacturing company of which he's CEO. Founder of an apprenticeship program called CareerWise Colorado, Ginsburg is now a Democratic candidate for governor running largely on a platform of training a skilled workforce.

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about families' return on their investment in tuition, higher education is increasingly seeking rather than resisting partnerships with business.

Across the country, in an auditorium at the Federal Reserve Bank in

“Education changes slowly and what’s happening out here in a factory or in an office is moving at the speed of light.”

—Noel Ginsburg, manufacturer and Democratic candidate for governor of Colorado running largely on a platform of training a skilled workforce

the heart of Boston’s financial district, for example, a standing-room-only crowd of educators, government officials, and employers piled into a daylong summit organized by the New England Board of Higher Education in December to come up with ways of doing something that also seemed obvious: “increase the career readiness of graduates” of colleges and universities.

“We heard employers saying, ‘We need grads who can hit the ground running,’” said Gloria Larson, president of Bentley University and one of the speakers. Bootcamps and other “disruptors,” said Worcester Polytechnic Institute President Laurie Leshin, “are making us think about things differently.”

Apprenticeships are also getting fresh attention as an alternative to going to college. More than 74 occupations, from tax preparation to graphic design, could be filled by people trained solely through apprenticeships, according to a new study by the Harvard Business School Project on Managing the Future of Work and Burning Glass Technologies, a software company that analyzes job data.

There remain opposing voices. Some faculty critics, for example, worry that collaborating with em-

ployers will transform their work from academic to vocational.

But students also clearly expect to learn job skills. Eighty-five percent of freshmen in an annual survey said they went to college to improve their employment prospects.

Already, demand from students for degrees they think are more closely connected to work has pushed down the number majoring in the humanities from a high of nearly one in five in the late 1960s to one in 20, according to the American Academy of Arts & Sciences.

“There will always be pockets of resistance, no matter where you are. But on the whole there was an openness to participate in this,” said Robert Park, director of Metro State’s Advanced Manufacturing Sciences Institute.

That doesn’t mean that pairing faculty with industry is easy.

“There tends to be a significant amount of inertia in academic institutions in general,” Park said. “And being responsive to industry’s needs is not necessarily a top priority for conventional or traditional academic programs.”

Nor are employers necessarily equipped for this.

“Business and industry tends to

fully automated assembly lines that moved inexorably by themselves.

“Businesses have to think about their role and that is as big of a challenge I think as universities changing,” Ginsburg said.

In Colorado, at least, employers have begun that work.

“They have to do this,” said Beth Cobert, who as former acting director of the U.S. Office of Personnel Management oversaw millions of federal employees and who is now CEO of Skillful, another effort to bring together colleges and corporations. Colorado has “a terrific economy and growing demand. So from employers’ point of view, there’s a willingness to try new things.”

Francisco Hansen has already benefited from that. He just graduated from Metro State with a degree in astrodynamics and aerospace operations after interning with a satellite company that has an office right on campus.

Hansen mapped out his own education with input from faculty and industry advisors. His department chairman, he said, “was, like, ‘This is what employers are looking for, so we need to include these classes in your degree.’”

The result, said Hansen: His education “was tailored for what I want



Metro State University’s new Advanced Manufacturing Sciences Institute, a \$60 million collaboration between the university and Colorado employers.

to do, rather than, ‘It’s just the way we’ve taught this stuff for 30 years.’” sit on the sidelines as an observer and then as a critic when they don’t get what they want,” said Ginsburg, in a conference room overlooking the 24-hour-a-day manufacturing plant of his company, Intertech Medical, in a sprawling industrial park on the fringes of Denver.

In the bright, clean room webbed with pipes and wires, workers in lab coats, gloves, and hairnets were inspecting tiny plastic parts coming off

to do, rather than, ‘It’s just the way we’ve taught this stuff for 30 years.’”

Skillful, which is underwritten by the New York-based Markle Foundation and so far operates only in Colorado, will soon expand into more states—though the foundation won’t say which ones.

“The real goal,” said Andi Rugg, its Denver-based executive director, “is that the system itself begin to change.” ©

Building a Bat Wing Glider

A Transportation Challenge



By Mike Fitzgerald
m.fitzgerald@juno.com

IN the following activity, students will construct model gliders from foam egg cartons. Through this activity, students will be introduced to the parts of an airplane and how to balance an airplane for maximum flight performance. During the first of this two-part activity, students construct a delta-, or “bat-wing,” style glider. In the second part, students design, construct, and test their own model of an aircraft built from inexpensive materials.

Procedures, Part 1

1. Hand out the supplied template to make a foam bat-wing glider.
2. Hand out scissors, knives, and foam egg cartons.
3. Have students cut out the paper template.
4. Have students place the template on the inside of the top lid of an egg carton.
5. Have students trace the pattern onto the top lid. They may discard the bottom of the carton.
6. Tell students that the pattern must include the wing tips that will face down. I have known my students to omit them because they think I made the photocopy too big.
7. Have students neatly cut out the pattern on the egg carton.
8. Have students test fly their planes. The planes will probably spin in the air like pinwheels.
9. Tell students that their planes must be balanced. If the weight they add (a penny or washer) is placed too far forward, their planes will dive. If the weight is placed too far rearward, their planes will stall and then crash.
10. Give students time to test fly their gliders.



Laying out the wing

Mike Fitzgerald taught technology education courses at Driver Middle School, Winchester, IN.

Building a Bat Wing Glider

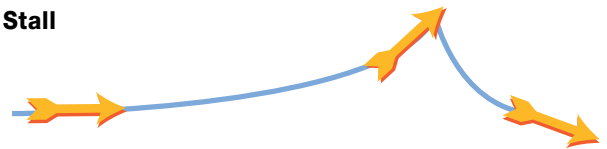
A Transportation Challenge



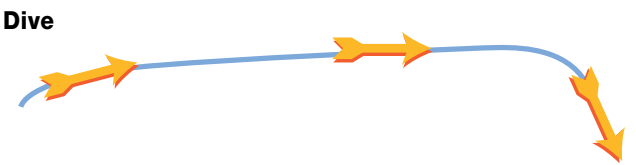
Procedures, Part 2

1. Introduce students to the design brief titled “Bat Wing Glider Challenge.”
2. Tell students about the parts of an aircraft—fuselage, main wing, vertical stabilizer, horizontal stabilizer, and ailerons. A scale model, such as an RC plane, may help you demonstrate the parts’ names and what the parts do.
3. Challenge students to design and construct a glider using a simple drawing or CAD software. They

Stall



Dive

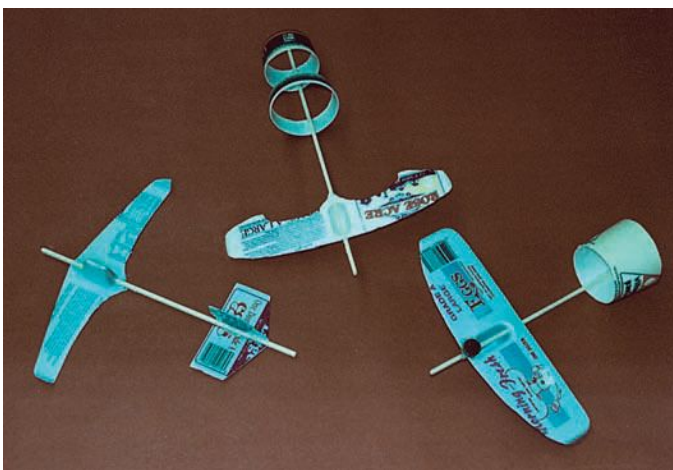


Level



Determining flight characteristics

should design and construct their own gliders which, using the software, may include a stick fuselage, main wing, vertical stabilizer, horizontal stabilizer, and ailerons. Students should also design and construct a catapult-launching system.



Sample craft from Part 2



Building a Bat Wing Glider

A Transportation Challenge

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- Wright, T., & Smith, B. (1998). *Understanding technology*. Tinley Park: Goodheart-Wilcox.

Internet Resources

- www.towerhobbies.com/—RC planes.
- <https://www.nasa.gov/audience/foreducators/index.html>—Great resources for aviation and aerospace-related education.
- <https://www.grc.nasa.gov/www/k-12/FoilSim/index.html>—Free airfoil simulation software.
- www.aiaa.org/—Free educator membership, grants, information.
- <http://education.msfc.nasa.gov/>—More NASA resources.



Building a Bat Wing Glider

A Transportation Challenge

Tools and Materials Required

- Foam egg cartons
(I use the one-dozen capacity size)
- Cool melt glue gun
- Cool melt glue sticks
- Razor knives
- Scissors
- Tape
- Pennies or washers
- Rubber bands
- Cardboard
- Scrap foam
- Tagboard paper
- Clothes pins
- Scrap wood— $3/8"$ x $1/4"$ x various lengths
- Computer with drawing software and printer

Building a Bat Wing Glider

A Transportation Challenge

Bat Wing Glider Challenge

As an aeronautical engineer, you have been assigned to the secret toy project called Bat Wing. Your challenge is to design, model, and test a model of a futuristic aircraft.

The aircraft should include such components as a fuselage, main wing, stabilizers, ailerons, and so forth.

Challenge: Design and construct a futuristic glider.

Time: Seven days.

Information/research: Any information on aerospace that you can obtain either from the textbook, library, or internet.

Materials: Foam egg cartons, paper clips, glue sticks, tape, white glue, pennies, washers, foam meat trays, cups, tagboard paper, cardboard, rubber bands, scrap wood— $3/8'' \times 1/4'' \times$ various lengths, clothes pins.

Tools: Scissors, cool melt glue gun, razor knives, computers with CAD software, and printer.

People: Teams of two students.

Evaluation: Gliders will be tested and evaluated in a large open space, such as the gymnasium. The gliders must land within a target that will be placed 25' away from their launch site.

Grades will be assigned according to the following rubric:

Grade	Performance	Craftsmanship	Planning
A	Lands on target	Excellent	Excellent
B	Lands within + or - 10' of target	Good	Good
C	Lands within + or - 15' of target	Fair	Fair
D/F	Does not land within 15' of target	Shaky	Poor

Building a Bat Wing Glider

A Transportation Challenge



Student Instructions

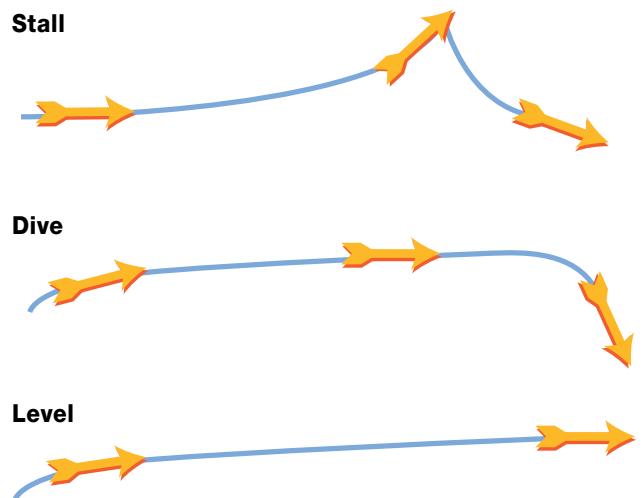
1. Neatly cut out the template. Then fold the template in half and remove the oval in the center.

2. Place the template on the inside of the top lid of an egg carton. Trace the template and cut out the outside edge. Be sure to include the wing tips! Do not cut out the inside oval.

3. Test fly your aircraft. If it does not fly well, then it must be balanced. Tape a penny on or near the nose and test fly the plane again. If your plane stalls, push the weight forward and test it again. If your plane dives, push the weight toward the plane's rear and test again.

4. Test your plane until you are happy with its flight characteristics. You have now successfully balanced your glider's center of gravity.

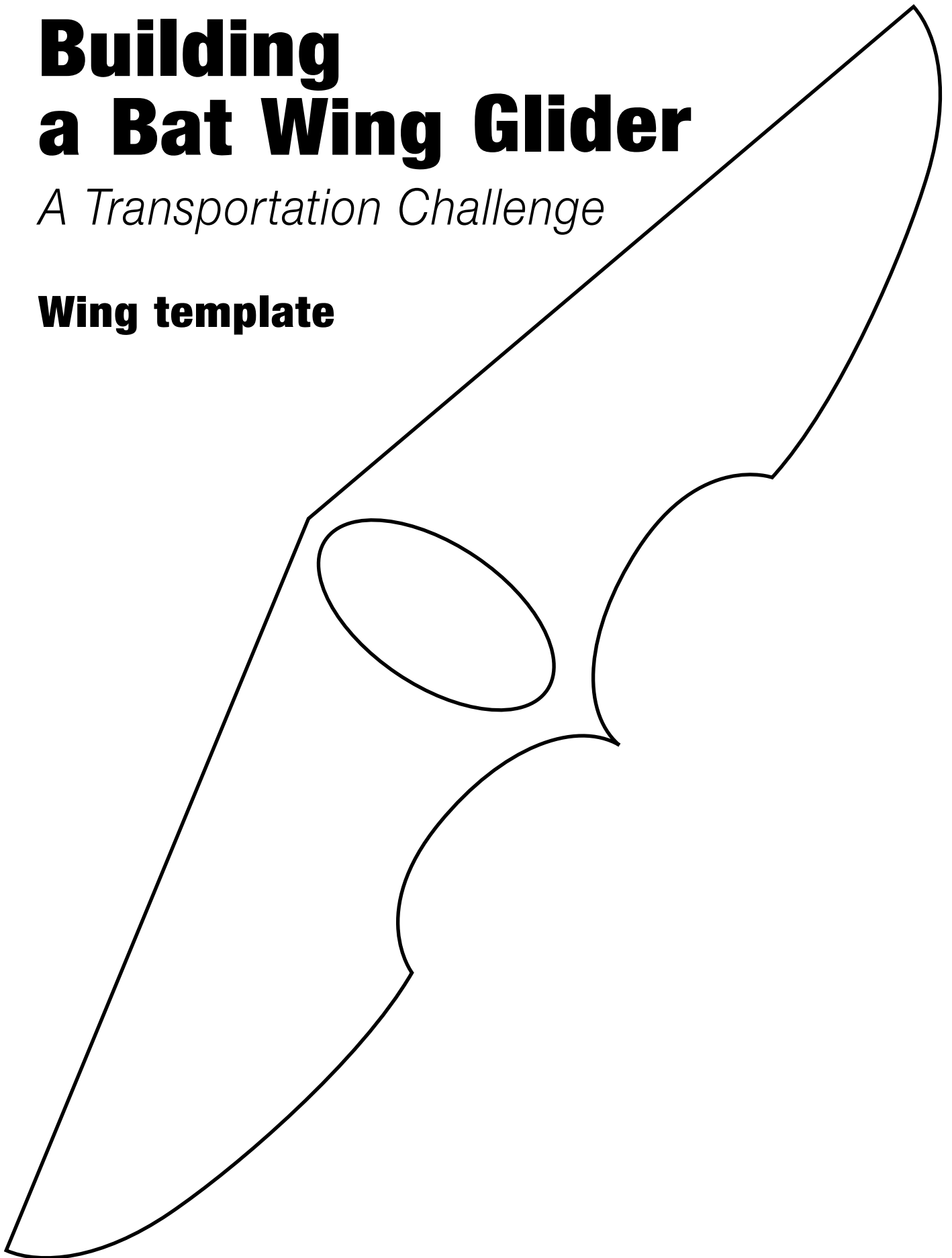
Use the chart below to help you determine the flight characteristics of your model.



Building a Bat Wing Glider

A Transportation Challenge

Wing template



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Thank you readers for catching a couple errors in puzzles that appeared in the November 2018 issue of **techdirections**! We have corrected them, and are republishing them so you have corrected versions to do yourself, or share with your students.

Answers on page 9.

more than fun

Crossnumber

Place the answers to the following problems in the spaces of the puzzle. Only one digit per square. Numbers must read from left to right and from top to bottom. Look for the key starting problem. All other problems are based on the solution to that one.

A	B	C		D	E	F
G				H		
	I		J			
K					L	
	M	N		O		
P				Q		R
S				T		

- | Across | Down |
|----------------------|-----------------------------|
| A. P down × 3 | A. K across - 8 |
| D. R down × 9 | B. M across × 100 - 927,163 |
| G. D across + 30 | C. H across × 10 - 45 |
| H. 10 ² | D. D across - 65 |
| I. H across × 251 | E. I across × 300 - 524,981 |
| K. 1/2 of L across | F. K across × 2 |
| L. 1/2 of H across | J. K across × 5 |
| M. I across + 64,430 | N. D down + 389 |
| P. C down - 316 | O. C down - 642 |
| Q. J down - 8 | P. R down - 12 |
| S. O down + 66 | R. H across - K across |
| T. H across + 295 | |

Builder's Word Search

Try to find the 42 construction terms hidden in this puzzle. Any builder worth his salt should be able to recognize them. After you've found the words, see if you can define them for an added challenge!

B	H	N	A	I	R	A	P	I	R	O	C	K	S	ARCHED	LUMBER
A	C	L	I	F	T	S	M	L	U	M	B	E	R	BALCONY	MANSSION
S	N	I	C	H	E	E	T	E	D	I	B	E	R	BASE	MARBLE
E	E	N	S	Y	S	T	E	M	S	T	O	L	E	BENCH	NEWELS
N	B	T	D	O	W	E	L	S	I	S	S	B	W	BIDET	NICHE
I	A	E	A	R	E	D	D	A	L	E	S	R	E	BOSS	NOSING
L	L	L	E	S	R	E	V	E	L	F	L	A	S	COILS	OUTLET
G	C	T	R	U	N	N	E	R	S	A	E	M	U	COPPER	RIPARIAN
A	O	U	T	I	L	I	T	I	E	S	W	A	O	DOME	ROCKS
R	N	O	S	I	N	G	A	B	L	E	E	N	H	DOWELS	RUNNERS
D	Y	N	A	M	I	T	E	I	T	I	N	S	E	DRAGLINE	SAFES
O	A	R	C	H	E	D	O	A	S	E	L	I	T	DYNAMITE	SEMI
M	R	E	P	P	O	C	L	E	A	K	S	O	A	FREESTANDING	SEWER
E	T	F	R	E	E	S	T	A	N	D	I	N	G	GABLE	SILLS
														GATEHOUSE	SLATE
														LADDER	SYSTEMS
														LEAKS	TILES
														LEVERS	TINS
														LIFTS	TRAY
														LINTEL	TREADS
														LOTS	UTILITIES

More than Fun Answers

Squared Up

The dimensions of the squares are 3×3 , 5×5 , 6×6 , 11×11 , 17×17 , 19×19 , 22×22 , 23×23 , 24×24 , and 25×25 .

To solve, let x = the length of the segment indicated in the diagram below. Then represent the lengths of other segments in the diagram in terms of x .

Since the opposite sides of a rectangle are congruent, you can solve for x by setting the two expressions equal to each other:

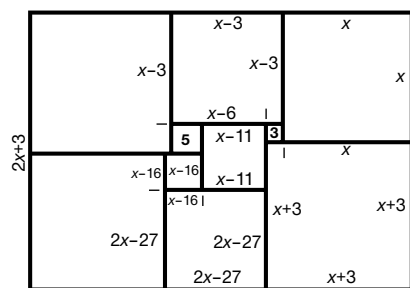
$$(2x - 27) + (x - 16) + 5 + (x - 3) = x + (x + 3)$$

$$4x - 41 = 2x + 3$$

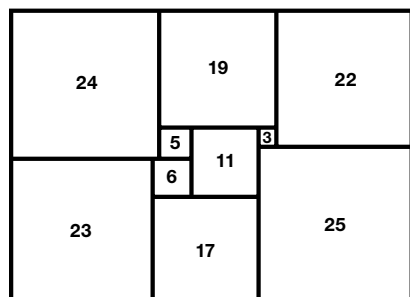
$$2x = 44$$

$$x = 22$$

Now go back and substitute 22 for x in all the expressions for the sides.



Here is the complete solution:



The dimensions of the rectangle are 65×47 .

Around the World in 80 Days?

Your head travels 37.7' farther than your feet.

Let r = the radius of the Earth

Let C_1 = the distance you feet travel

Let C_2 = the distance your head travels

$$C_1 = 2\pi r$$

$$C_2 = 2\pi(r + 6)$$

$$C_2 = 2\pi r + 12\pi$$

$$\text{So, } C_2 - C_1 = (2\pi r + 12\pi) - (2\pi r)$$

$$C_2 - C_1 = 12\pi \text{ or } 37.7'$$

Word Scramble

SEVAW GROJAN
WAVES JARGON
INSEP SHWICT
SPINE SWITCH

When unscrambled, the letters in the squares should read:

JOSEPH SWAN

Though earlier inventors had tried, with limited success, Sir Joseph Wilson Swan, of Britain, invented the first practical incandescent light bulb in 1860. The efficiency of his first light bulbs was severely compromised by their carbonized paper filaments, which significantly limited bulb life to a few hours. Later, he would improve the filament, first by using carbon fiber (in 1873), then by using slim carbon rods (in 1877). Though these later bulb designs consumed considerable amperage, they lasted long enough for practical commercial use. So, in 1881, Swan founded his own company to manufacture and market his light bulbs.

Meanwhile, across the Atlantic, Thomas Edison had purchased a rival—although far inferior—light bulb patent for \$5,000. Edison and his team at Menlo Park spent much time experimenting with better filaments, until eventually they found a filament material superior to Swan's. Edison founded his own light bulb manufacturing company, which later merged with Swan's company—and eventually bought Swan out.

But Is It Worth It?

Construct a table and look for a pattern:

Day #	Amount Earned on that Day	Total Earned
1	.01	.01
2	.02	.03
3	.04	.07
4	.08	.15
5	.16	.31
6	.32	.63
7	.64	\$1.27
8	\$1.28	\$2.55
...
30	$2^{29}/100 = \$5,368,709.12$	\$10,737,418.23

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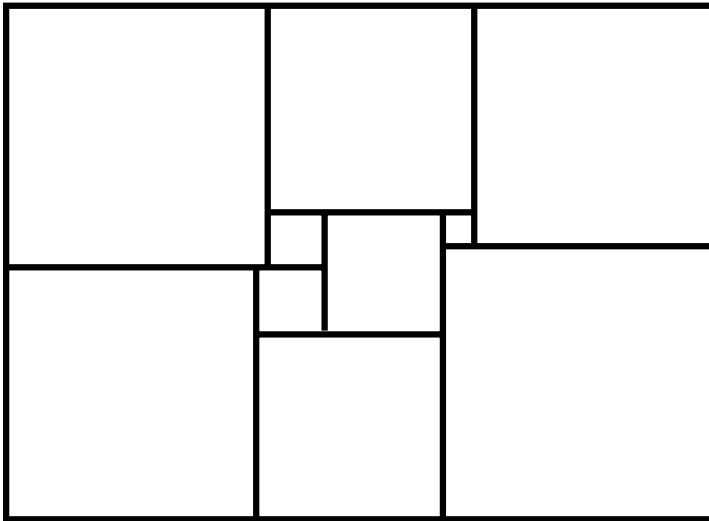
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Squared Up

The rectangle below is made of 10 squares, each of a different size. The dimensions of the two smallest squares are 3×3 and 5×5 . Use math to determine the dimensions of all the other squares.

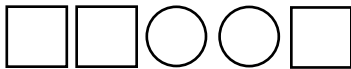


Puzzle devised by David Pleacher, www.pleacher.com/mp/mpframe.html

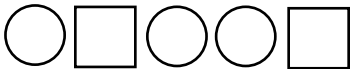
Word Scramble

Most people think Thomas Edison invented the light bulb. In fact, he merely discovered a better, longer-lasting filament for light bulbs. To discover the true inventor of the incandescent light bulb, first unscramble the four science-related words below. Write each answer in the line of squares and circles provided below each word. Then unscramble the letters in the squares to learn the answer.

SEVAW



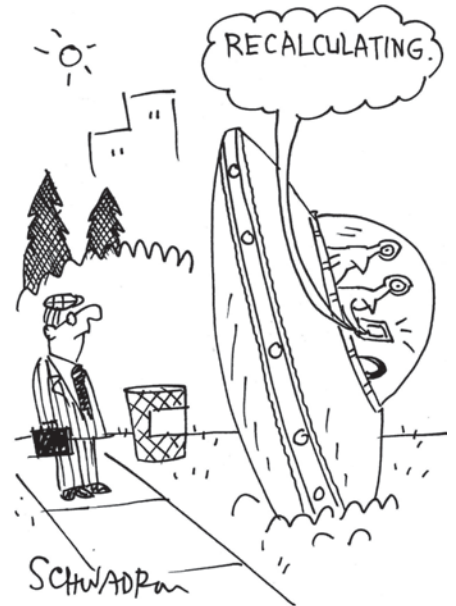
INSEP



GROJAN



SHWICT



Around the World in 80 Days?

Suppose you are 6' tall and you walk around the Earth's equator. How much farther does your head travel than your feet?

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

But Is It Worth It?

You are offered the following job opportunity:
 You are to work for 30 days.
 On the first day, you will be paid a penny.
 On the second day, you will be paid 2¢.
 On the third day, you will be paid 4¢.
 On the fourth day, you will be paid 8¢, and so on for 30 days.
 How much would you make for the thirty days?
 Do not use a calculator!

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

See answers on page 37.

We pay \$25 for brain teasers 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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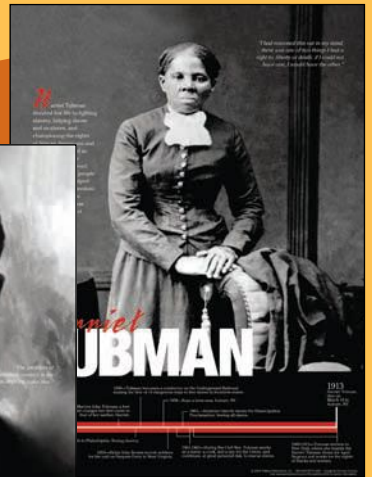
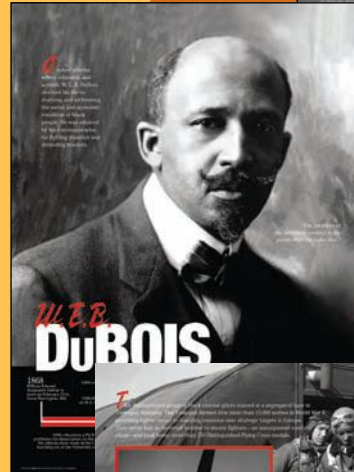
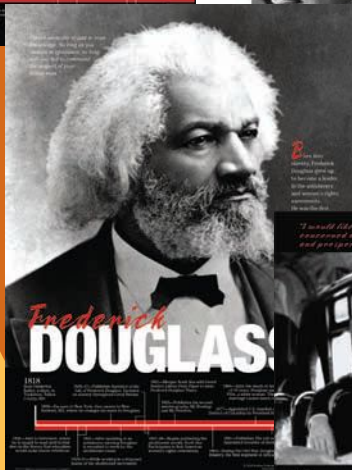
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