STEM

MAGAZINE

The "S" in STEM

Systematic Accumulation of Knowledge

Lesson-Sharing

Services in Demand

Computational Thinking:

Putting the pieces together

February 2016
\\187v

STEM Innovations

A Math and Science Partnership Initiative in Northwest Indiana

Dear Educators,

As we enter the second half of the school year your STEM Innovations design team is hard at work developing the two professional development sessions for faculty who attended the 2015 Summer Institute. Registration is underway for the **first session on Monday, February 8th** for the training at Merrillville High School: 276 E 68th Pl, Merrillville, IN 46410. Check-in starts at 8:00 am and the session will begin promptly at 8:30 am.
CLICK HERE to register.

SAVE THE DATES! We are excited to announce that the **2016 STEM Innovations Summer Institute will be June 13-17, 2016,** at Merrillville High School.

The week-long institute is designed to strengthen STEM focused leadership and instructional capacity through high quality professional development. During the week you will have the opportunity to experience the camaraderie of colleagues from your school and surrounding schools. Math and science teachers of grades 7, 8, and 9 will join together to engage in the over-arching goals of the grant. Watch your emails for updates and links to register.

Of exciting news is the most recent Lesson Study Experience hosted at Colonel Wheeler Middle School in Crown Point. Dr. Marion Hoyda and Jim Hardman, Crown Point's Director of Curriculum & Instruction, worked with 8th grade science teacher, Susan Whitehouse, to plan and implement a DNA extraction from strawberries unit to her students.

Several faculty members from Crown Point and School City of Hammond spent the morning observing the lesson in Ms. Whitehouse's class. Prior to the classroom observation, in a pre-meeting, Ms Whitehouse described what she expected from the lesson and she asked observers to collect data for three areas:

- Communication among students
- Collaboration among students
- The degree to which students followed the lab protocol

Following the class period, participants shared the observations they made and had an in depth discussion of STEM and engineering education in particular. They also gained insights individually and collectively. We are thankful to our Crown Point participants for setting the pace for this enhanced dimension to the STEM Innovations program. and to Corey Mathis, doctoral candidate at Purdue University, for creating the DNA extraction unit that Ms. Whitehouse used.

At this time, two MSP districts have expressed a strong interest in conducting a lesson study experience and are making preliminary plans with Dr. Hoyda.

We look forward to more opportunities for the STEM Innovations districts through offline professional development activities in the coming months.

Your STEM Innovations Team

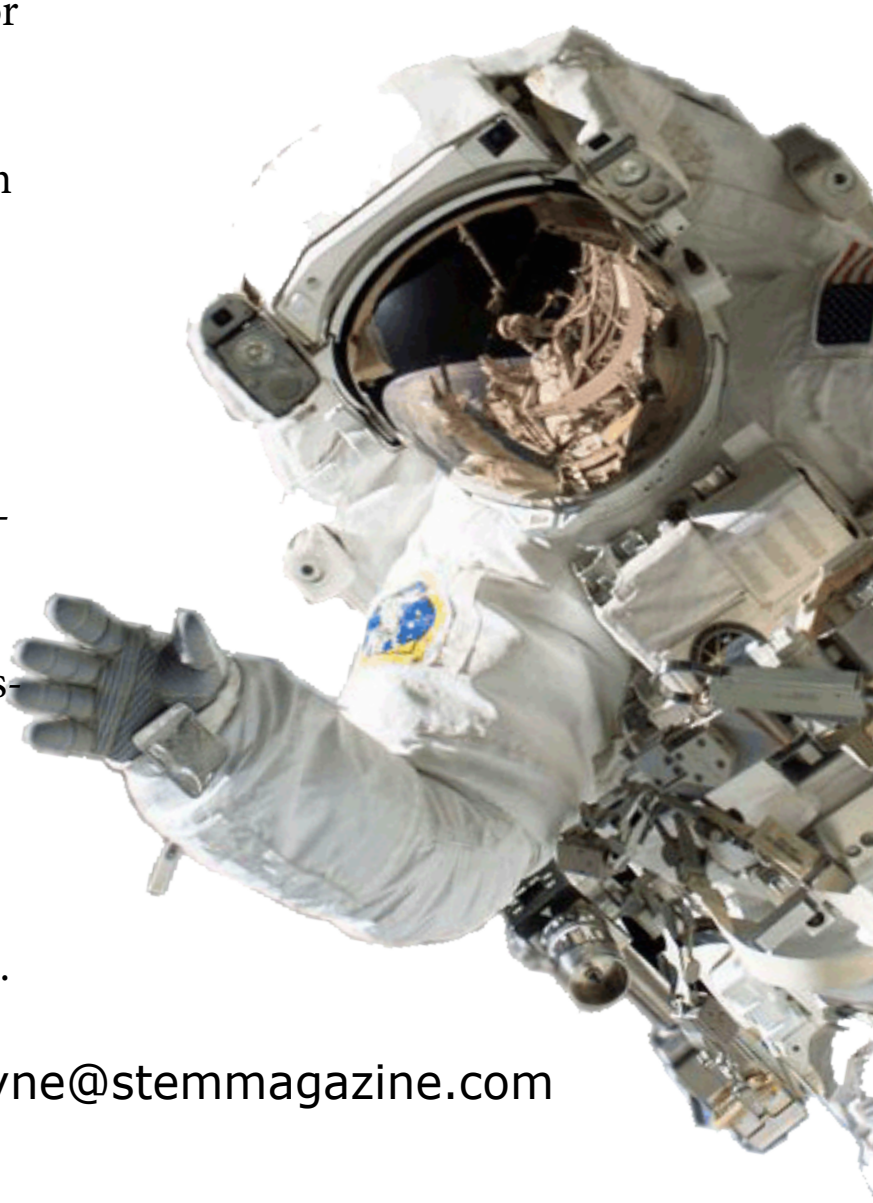
MERRILLVILLE COMMUNITY SCHOOL CORPORATION

STEM Magazine is a non-profit monthly education publication for teachers, students, their parents and administrators. CEO Wayne Carley is the publisher and senior editor for all content in S.T.E.M. Magazine.

We believe that the key to success in seeing higher graduation rates, improved testing results, student inspiration, creativity, excitement and career satisfaction rest in the hands of the teacher. The example and inspiration of individual educators carries tremendous weight on a daily basis, greatly impacting the quality and effectiveness of the classroom environment.

Our mission: Encourage curiosity, inspiration and creativity, the foundations of every career passion.

STEM Magazine is also PDF printable and mobile device friendly.



Wayne Carley
Publisher
STEM Magazine
wayne@stemmagazine.com

Use it in class. Use the smart board.

Send this link home with your students so they can share with their parents, connect and talk about STEM careers and how best to prepare.....together.

Curiosity and learning are ageless.

Contents:

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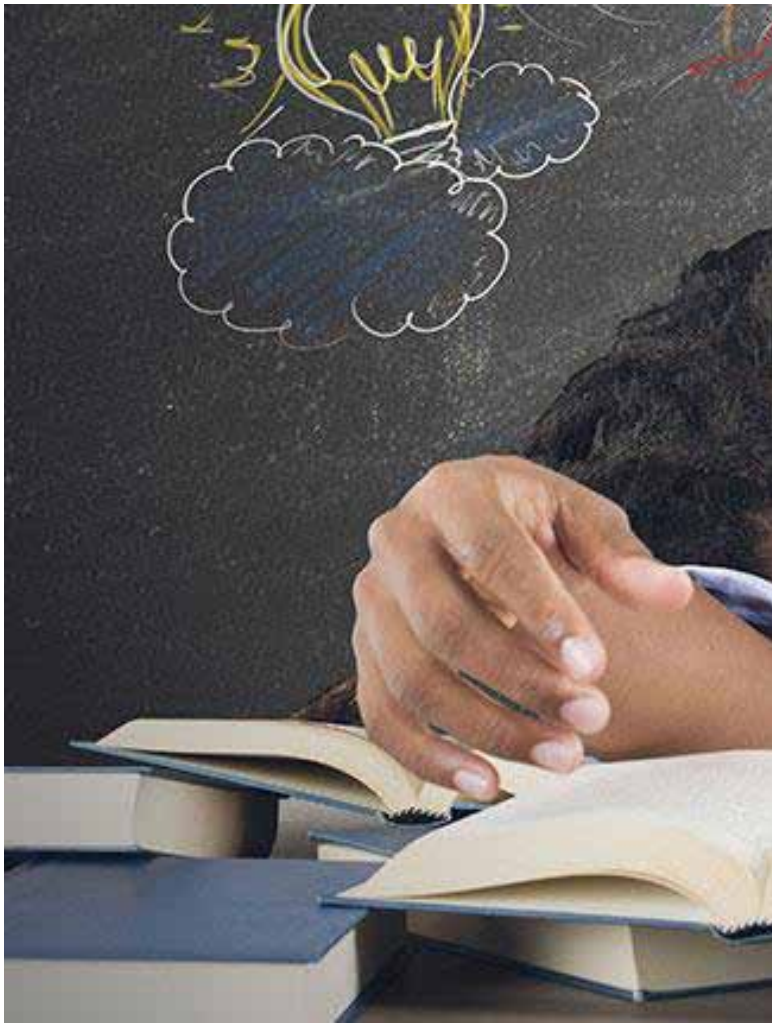
Lesson-Sharing
Services Fulfill a Demand

Dr. Richard Larson **MIT**

Lesson sharing occurs when a teacher prepares her/his lesson for others to use and posts it on the Internet. In recent years, lesson-sharing services have grown exponentially. Demand for shared lessons is creating a large supply. Common standards make this possible. Teachers in the United States are overwhelmed by teaching hours, both in class preparation and in front of the classroom.

A recent OECD study found that U.S. teachers rank second after Chile in terms of class time spent in front of students. For instance, despite Japanese schools teaching four extra weeks per year, Japanese primary school teachers only spend 707 hours per year teaching compared to the 1100 hours per year for their US counterparts (OECD, 2012).

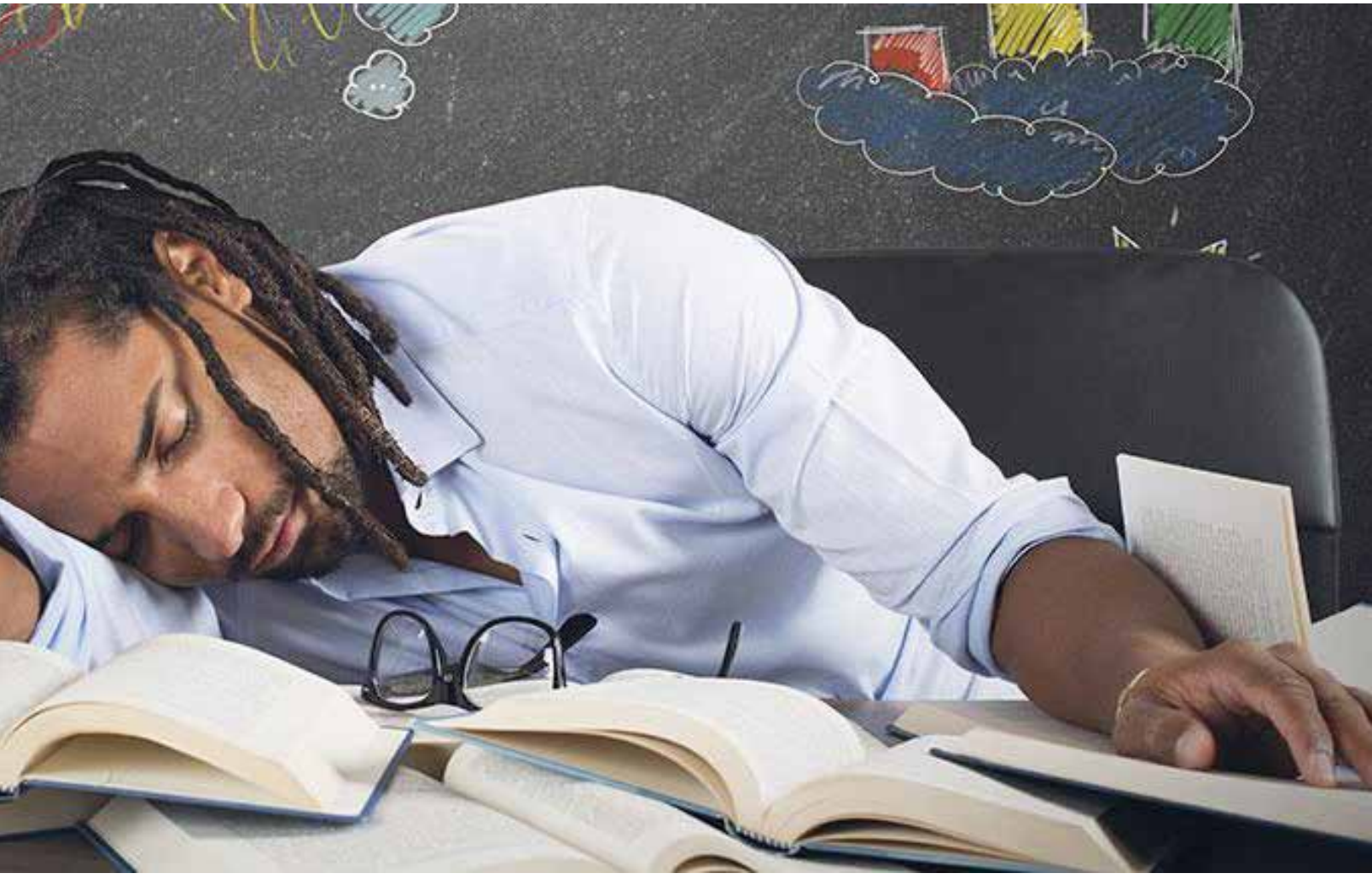
This difference is even greater at the middle- and high-school levels, where US teachers spend 1070 and 1050 hours respectively compared to 602 and 500 hours for Japanese teachers. Despite these large differences in instructional time, teachers in the two countries work comparable hours in total (1899 hours in Japan and between 1913 and 1998 hours in the United States, according to the OECD).



Teachers in the United States are expected to grade student work, perform administrative work, and prepare high quality lessons, all within one hour for each hour they spend in front of the classroom. Japanese teachers have approximately three hours of preparatory time for each hour they spend actively teaching. While many U.S. teachers compensate by working even longer hours, such a path is not sustainable and contributes to high teacher turnover rates.

In a bid to help overwhelmed teachers move away from daily handmade lesson planning, some educators have begun to share their lessons online.

While lesson sharing traditionally occurs within individual schools, the Internet allows teachers to post their lessons online so colleagues from around the globe can benefit. Today there are numerous lesson-sharing services.



They typically consist of large databases of lesson plans, as well as accompanying materials or videos, organized by content and grade level. In this way, lesson-sharing services can be viewed as an attempt to "crowdsource" lesson planning and allow teachers to harness resources that have already been created elsewhere. Lesson-sharing services now have wide followings.

TeachersPayTeachers.com, for instance, has more than 750,000 lessons that have been downloaded 13.7 million times (TeachersPayTeachers.com). One kindergarten teacher, Deanna Jump, has earnings from TeachersPayTeachers in excess on $1,000,000. Total teacher earnings have exceeded $30,000,000 (EdSurge, 2013).

BetterLesson.com has more than 600,000 lessons, and in 2013 averaged greater than 300,000 visitors a month. ShareMyLesson.com, a project of the American Federation of Teachers, has been one of the fastest growing of these services, with nearly 250,000 lessons contributed in its first year of operation.

Khan Academy has more than 3000 lectures created by Sal Khan and other experts; combined, they have been viewed more than 320 million times (KhanAcademy.com).

MIT BLOSSOMS has more than 100 shared interactive lessons created by teachers and students in nine different countries. Although the online lesson-sharing space is diverse and each of these services utilizes a unique approach, all lesson-sharing services have two main goals: public posting of lesson plans and curation to help organize and identify the appropriate lesson for each teacher.

To achieve these goals, lesson-sharing services either use experts or crowd-sourcing, with and without money exchanged.

Crowd-sourced lesson sharing is accomplished by enabling teachers to upload their lesson plans, to be shared online. BetterLesson, ShareMyLesson and TeachersPayTeachers are examples. Participating teachers are motivated either by altruism (BetterLesson and ShareMyLesson) or by possible monetary gain (TeachersPayTeachers).

Crowd-sourcing results in each of the sites having hundreds of thousands of lessons. However, such large numbers create problems for users.

There is little information about lesson quality, and the numbers are so large that individual experts cannot curate the collections to identify high-quality lessons. Instead, these services often rely on user-teachers to rate each lesson individually; this happens after or, more likely, before they ever use them in their classrooms.

With such unreliable ranking systems, teachers must spend time sorting through myriad online lessons for potential adaptation to their own specific needs, often leading to little or no time saved compared to the homemade craft alternative.

NATIONAL SECURITY PART 2

Encrypt [en-kript]
verb (used with object)
1. to encipher or encode.

Did you miss it?

The page was ***not*** blank.

Let's try again:

1. Highlight the page with your cursor and choose black as your font color. Ta-Da....there it is.

Now, go to this website:

https://paulschou.com/tools/xlate/

2. Copy the binary code (the first group) and paste it into the "binary" block, then click "decode".

Just above in the text window is the translation of the first part.

3. Now, before you do the other codes, notice how the first one looks in the other boxes of other code types. Compare and see if you notice any similarities.....

It looks like you have 3 different code types, so copy and paste the correct type in the appropriate box to "decode".

Drop me an E-mail at this address with the complete code translation:

wayne@stemmagazine.com

I think this is fun and aside from have recreation uses, it's a good introduction into coding and how easy it is with the right tools.

CLICK HERE FOR THE ENCRYPTED MESSAGE TO BREAK

The S in STEM

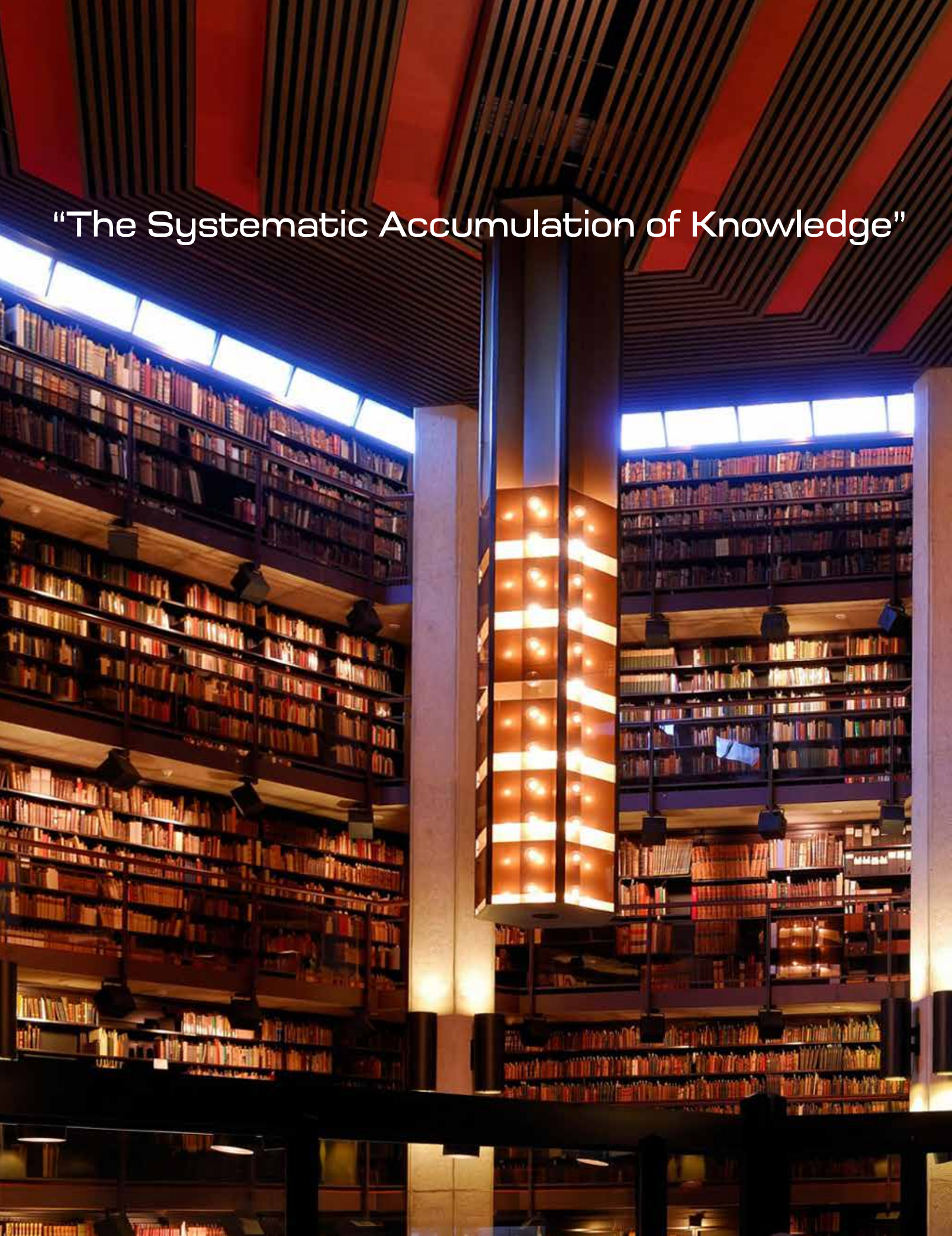
As with most words, there are several definitions to choose from, though very similar in meaning. Science is most often associated with the physical world and careers such as biology and medicine. Several definitions of science are interestingly similar, so for the sake of this STEM discussion we'll use these three:

- knowledge, as of facts or principles; knowledge gained by systematic study.

- systematized knowledge in general.

- skill, especially reflecting a precise application of facts or principles; proficiency.

Name one career, in any field of study, and the "systematic acquisition of knowledge" is a daily necessity. ***No matter what job you have***, from mechanic to astronaut, the addition of new knowledge is necessary to be competent, better and complete in that field.


"The Systematic Accumulation of Knowledge"

This process of "continued learning" has never been more true than now, as innovation, technology, discovery and imagination change almost daily.

If we....all of us....stop learning new skills for our profession, we are falling behind, and as everyone knows, the further behind we fall, the harder it is to catch up. Fact is, the falling behind is our choice often seen in maturing adults who have stopped learning. So back to our belief that every career is a STEM career.

The systematic (having, showing, or involving a system, method, or plan) learning often has to be done in a specific order so it's learned and applied correctly. Step by step is the process, from basic math or coding to physics and complex software development.

You start at A and work your way to Z. Anything can be learned by anyone using this systematic approach. You may get stuck on H or J in the process until you "get it", then you move on to K and so forth. I didn't know how to walk at one point until I took my first step....then another and another. Soon I was running.

Pick any job, sport, hobby, video game or activity you can imagine and this process is necessary.

I myself plan to spend the rest of my life learning something today I didn't know yesterday, partly because I need to do more than just keep up, but actually lead the way. If the average teenager, young adult, mature adult.... or teacher plans to stay "employable" in the changing world, Science as the systematic and continual accumulation and application of knowledge need to become our lifestyle.

Sports uses science
Auto mechanics uses science
Nursing uses science
Plumbers use science
Piloting uses science
Carpentry uses science

You've already started, so just continue, maybe even pick up the pace, and pursue to systematic accumulation and application of new knowledge in whatever direction you choose.

Male or female, you have **NO** limits since we all start at "A".

S.T.E.M. WON'T WORK.....*UNLESS*.....

by Franklin Schargel

"There is no doubt that technology, science, mathematics and engineering are driving our economy and will continue to do so for the foreseeable future."

S.T.E.M. programs can only succeed if sufficient numbers of students ***wish*** to become involved with math, science, engineering and math. Increasingly our nation is becoming more ethnically, religiously and cultural diverse. And although the demands of society have changed, schools tend to be risk-adverse.

For example, we are still using school calendars that are based on an agrarian society. We allow students to leave school in the fall to plant crops.

We close schools in the summer to allow students to harvest them. We still attempt to fill heads with information and then test using rote,

regimen and regurgitation while businesses and society need graduates who are problem solvers capable of working on teams.

In most classrooms teachers stand in front of students reading material from books as if there is only one answer to each problem and the teacher knows it expecting students to guess it correctly.

In order to make S.T.E.M. successful we need to do the following things:

- Build a foundation for S.T.E.M. in elementary schools. In the United States, elementary school teachers are licensed in Elementary Education. They are generalists who know and teach the vast variety of subjects that need to be taught to 5-8 year olds. They do not major in science, technology, math or science.

High performing countries like in Finland and China use specialists who are brought into elementary school classrooms to supplement the teacher's knowledge of S.T.E.M subjects.

- Colleges need to change their curricular teaching to what students need, not what colleges and teachers think students should learn.

- Educating Parents – Do you remember when educational experts suggested "new math" or the "metric system' into America's schools? One of the reasons they failed is because parents who were expected to help their children with homework were ill-equipped to help their children.

Parents need to be involved with the learning process. One way is to bring them up to speed on STEM, and magazines like this one can be a resource for that involvement.

I visited the Promesa Early Learning Center. In Albuquerque New Mexico which hosts the Homework Diner program. The program invites parents and students to come to dinner where students are helped by parents and staff to do homework. The Diner is supported by local and national businesses.

- Business Mentorships – Businesses have the most to lose if schools are not working to their full potential.

Therefore it is critical that businesses (especially those which focus on science, technology, math and engineering) lend schools experts in the field. There is a critical shortage in many schools in teachers who

majored in those fields.

- Lower School Dropout Rates – Although the nation's graduation rate has risen to 82 percent, there are still pockets in states and school districts where student graduation rates are far below 82 percent.

- Narrow a variety of gaps:
  - Achievement
  - Computer usage
  - Gender roles

- Increase minority attendance at colleges. As the number of ethnic and racial minorities increase in K-12 classrooms, so should the number of minorities going into teaching increase as well.

- Emphasize school achievement as much as school sports. Schools recognize the importance of sports by giving our awards, placing trophies in display cases, honoring the players and their parents, and giving out team jackets. They should do the same for students who achieve academic excellence.

I do not doubt that America is up for the challenge. We have the capacity. Do we may lack is the will?

STEM *Integration* into your class today and everyday.

"My class is not a STEM class. I'm an English teacher."

If I may, let me gently correct you. Yes, you are a STEM teacher as you are using, expecting and encouraging ***STEM skills*** with every assignment, lecture and test.

As an earlier article in this issue made clear, science is the "systematic accumulation of knowledge" and is absolutely necessary for any term paper, history lesson or learning evaluation. So, there is the "S" in STEM. The use of Google, online libraries, computer and software use, all of which are a daily part of your class and homework assignments is obviously the "T" for technology. They are only "users" of the technology rather than innovators, but still attached to the "T".

"E" for engineering is the use of the engineering method (a decision making process) that make a term paper or other writing assignment impossible to accomplish without. Simple decisions about how to organize and prioritize content is a perfect example of that method. We use it 10 times a day if not more, and English class is not exception.

Math, the "M" of STEM is also used to a lesser degree perhaps, but used non the less. From a simple "word count" calculation, which happens to tie in closely to the engineering method of decisions, to statistics, dates, time spans and more, some level of basic math is included.

Here we have shown how STEM skills are a regular part of the typical English class. The question remains, is the English teacher even aware of this. I'll stick my neck out and suggest "no", not for most. Why not?

It may be a simple lack of awareness, which happens to be a primary objective of STEM Magazine. *"But why should I really care?"*

Students NEED to see the practical connection between what is being taught and why they need to learn that information. Name one career that does not require some form of written communication daily, either from filling out forms or sending E-mails to clients or preparing written presentations to acquire new customers or clients?

The skill set needed is not just creative writing, but the ***complete set*** of STEM skills and more importantly, the knowledge that they are using them.

Aside from your curriculum, this too is your responsibility to adequately prepare your student to enter the work force.

Here is your "Verbal Integration" opportunity and it only takes about *30 seconds.*

- Bring to the attention of your students that they are using a type of science to do their assignment *(the systematic accumulation of knowledge).*

Now they begin to make a conscience connection between the assignment and the "S" in STEM. The journey begins. If you have another 30 seconds, ask someone to name any job that requires writing something regularly.

This simple and "non-curriculum" type of integration and awareness has value far beyond our understanding, both for the educator, student and parent.

You're smart enough to make these types of connections in your subject field so I'll end the article here, but our responsibility as educators to prepare our students goes well beyond our specific subject field and this type of easy integration should not be a burden to any of us. Fact is, it can be fun and potentially improve the performance of students as they make these connections early in their scholastic development.

This is cool

You thought drones were cool....check this out.

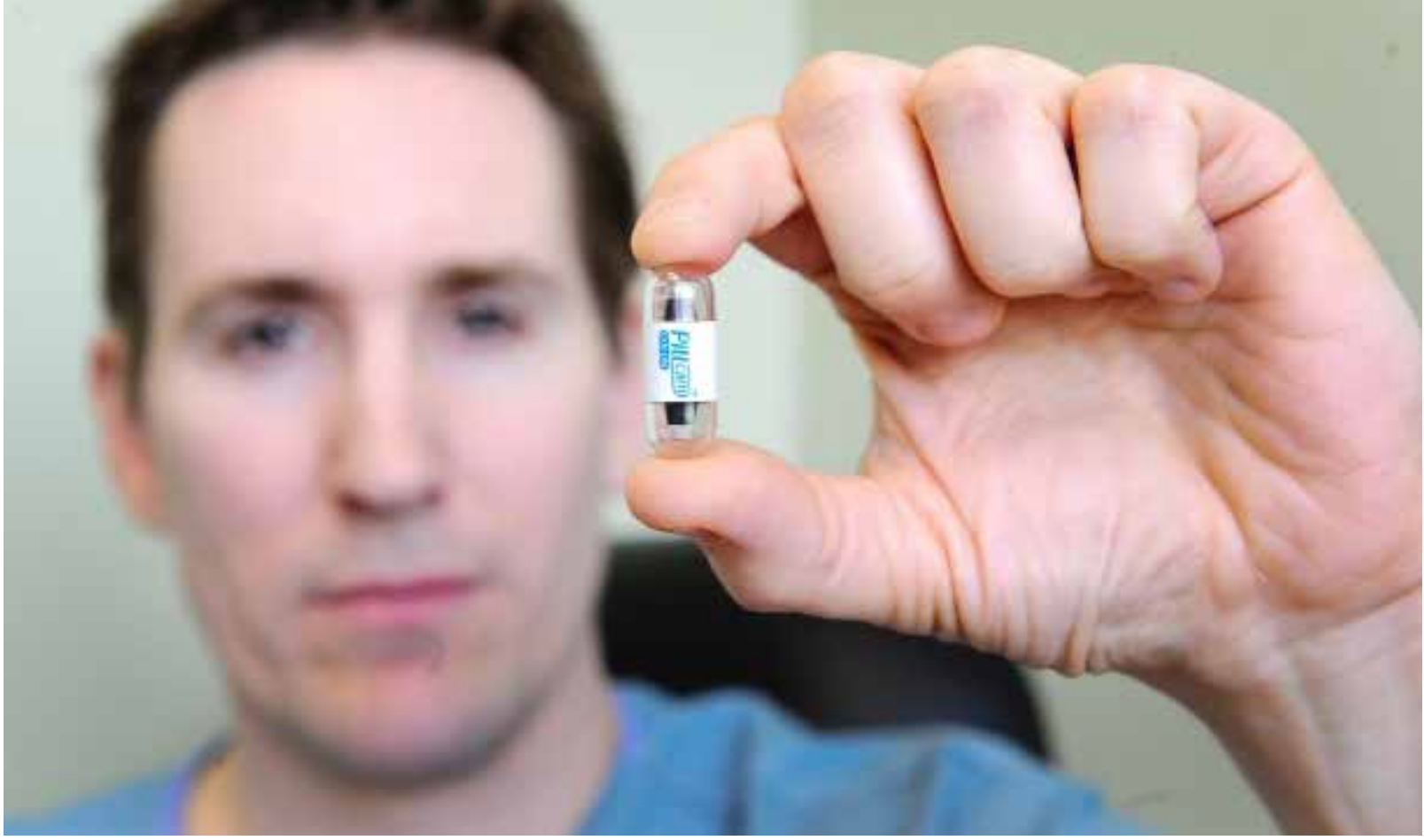
If you are considering a profession in the medical field, which is of course a STEM career and FULL of STEM skills and applications, the innovations you'll learn about and use will seem like science fiction. This is way cool.

When you don't know what's happening in your body, it's hard not to worry. The PillCam SB capsule endoscopy procedure is a safe, simple way to view your entire small bowel from the inside out. Seeing parts of your body that you've likely never seen can give your doctor insight – and give you confidence in your treatment plan.

PillCam SB doesn't require sedation, the use of potentially dangerous chemicals or injections or inserting tubes into your digestive tract. And, aside from not eating for 10 hours before the procedure (generally overnight), it requires no preparation.

Direct visualization of the small bowel is necessary to accurately and fully assess early disease activity and progression. PillCam SB is able to directly see the early stages of small abnormalities, where other X-rays and scans may not be effective. Because PillCam SB can aid in the early detection of problems and early disease responds better to treatment, it could potentially improve your overall quality of life.

The capsule is equipped with a miniature video camera and light source It travels painlessly through your entire digestive tract. It captures images quickly and sends them to a recording device you wear during the procedure. Keep in mind, your digestive system is ***23 feet long***, so it takes a while for the Pill Cam to take its trip. What a great addition to the family photo album.



Groundbreaking study finds boys <u>are not</u> naturally better than girls at math…but your daughter may be more ***anxious*** about math.

Dr. Tom Brunner
Psychologist, Counselor & Consultant

There is a stereotype that boys are better at math than girls. Boys do hard edged stuff like football and math, and girls do softer or more "girly" stuff… right? In other nations this is simply not true.

Given analysis of data from 276,000 children from 41 countries (published in the top tier peer-reviewed journal called Science), a researcher named Paolo Sapienza found that while in the U.S. boys outperformed girls by an average of 10 points (highly statistically significant), in numerous other countries like Sweden and Iceland, there was no statistical difference. This researcher could not explain why, but a neuroscientist who has developed a

computer game to strengthen memory has some ideas.

Dr. Torkel Klingberg believes that boys out-perform girls in math in cultures where there is an expectation that boys are stronger than girls in math (and other skill areas). He supports his idea by drawing from data that shows there is a direct correlation between countries where there are stronger gender gaps and gender stereotypes (as measured by what is known as the Gender Gap Index[GGI]) and where boys outperform girls in stereotypical ways.

In other words, the background cultural beliefs about what people should be good at seem to actually affect performance, in big ways. There is certainly a large body of scientific evidence about how ***expectations*** affect performance. But you may ask, "what is the mechanism in play here…what is going on?".

Here is where things get even more interesting: Dr. Klingberg makes a further point by discussing an intriguing study finding. There was a study of how men and women are affected by math anxiety. I quote a summary already provided in Psychology Today:

"When participants were told that they were about to perform a working memory task (which included math operations as a kind of distractor) to get norms for student, men and women performed equally. But when the same test was given with the information that this was a test of complex mathematics in order to compare males and females, performance in ***female participants dropped almost 30 percent.***

The experiment was repeated, now with both working memory and math tests. Again, the females who were informed that they were going to take a math test performed worse, on both math and working memory tests. The researchers could also show that the stress was most closely associated to impairments in working memory, and it was the impaired working memory which caused the lower math performance."

Dr. Klingberg ended by stating that the link between working memory and math is well established, as his previous research has shown. And **stress** is one of the most powerful factors that cause the working memory capacity to go up and down from one moment to the next.

In this study, females seemed to perform much more poorly when they knew they would be compared to boys. It would seem that the females went into this testing condition feeling **stressed out.**

Emotional Women, Emotional Men

by Dennis Thompson Jr.

Recent research has shown important ways in which men and women react emotionally and perceive emotion in others:

A global study of 55 cultures found that women tend to be more emotional, agreeable, extroverted, and conscientious than men.

- Women read other people's emotional reactions better than men, regardless of whether they receive those emotional cues verbally or visually.

- Women reported experiencing love and anger much more intensely than men did in another assessment of gender differences in emotional response. These women also smiled more when recalling memories of happiness or love.

- Men and women respond to stress in different ways.

Women display greater sadness or anxiety than men, while men show an increase in blood pressure and a tendency toward alcohol craving.

How Gender Differences Affect Health

Gender differences in emotional processing and response have direct consequences on the physical and emotional health of boy, girls, men and women.

Overly emotional women tend to be at greater risk for depression, anxiety, and other mood disorders, while men who repress their feelings tend to be at greater risk for physical ailments such as high blood pressure, and also tend to indulge in more risky behavior. We see this at an early age in school and find ourselves confused about how to help.

Some argue that we should accept these gender differences, based on the fact that feminine women and masculine men tend to be happier than those who are gender-atypical. According to this line of reasoning, boys and girls should be allowed to develop both stereotypical and non-stereotypical emotional responses without judging them or trying to shape them.

As we consider the "balance" of gender in the work force, we cannot forget that the genders are not created equal across the board. Each has biological tendencies that can be very complimentary.....or not.

Math stress and stress in general begin early in the life of a student.

Who teaches them how to handle stress?

What class is that?

Question Everything!

The big "I Don't Know"

By Andrew McMillan / Wayne Carley

For thousands of years, most of the science that was taught to students was wrong. Even in my life time, since the 1960's, much of what I was taught has been dis-proven or modified extensively.

700 B.C.: **fact** - the earth is flat. *Wrong*
Fact - the earth is the center of the universe. *Wrong*

600 B.C. : **fact** - the sun revolves around the earth. *Wrong*

1838: Darwin evolutionary theories. We have no idea and no evidence or "missing link".

1915: Einstein's General theories of Relativity. Some evidence, some guessing. Einstein's theories continue to be ***adjusted*** as we learn more.

Before 1917: **fact**- the atom is the smallest particle in the universe. *Wrong*

About 1917: **Fact** - Electrons are round. *Wrong* (string theory...still in progress)

Before 1920: Einstein theory - **Fact** - the universe was static /stationary (not moving). *Wrong ?*

1929: **fact**- the universe is expanding. "The Big Bang", (Expansionism Theory) *maybe....*

Recent theories: the universe is contracting..."The Big Crunch" theory. *Maybe....*

1947. **Fact**- nothing can travel faster than sound. *Wrong*

1959. **Fact** - the neutrino exist and is the smallest particle in the universe able to travel faster than light. *Maybe....*

Common myth: **Fact** - Lighting doesn't strike the same place twice. *Wrong*

Today. **Fact** - The universe is infinite, but if the universe is constantly expanding, what is it expanding into? How can it be infinite? We will never know.

Today: Black holes- the world's foremost physicists agree, *"We just don't understand this, and black holes may not even really exist, but observations say they probably do"*.

Current theory: Black holes are not really holes but solid objects of incredible density with no external features.

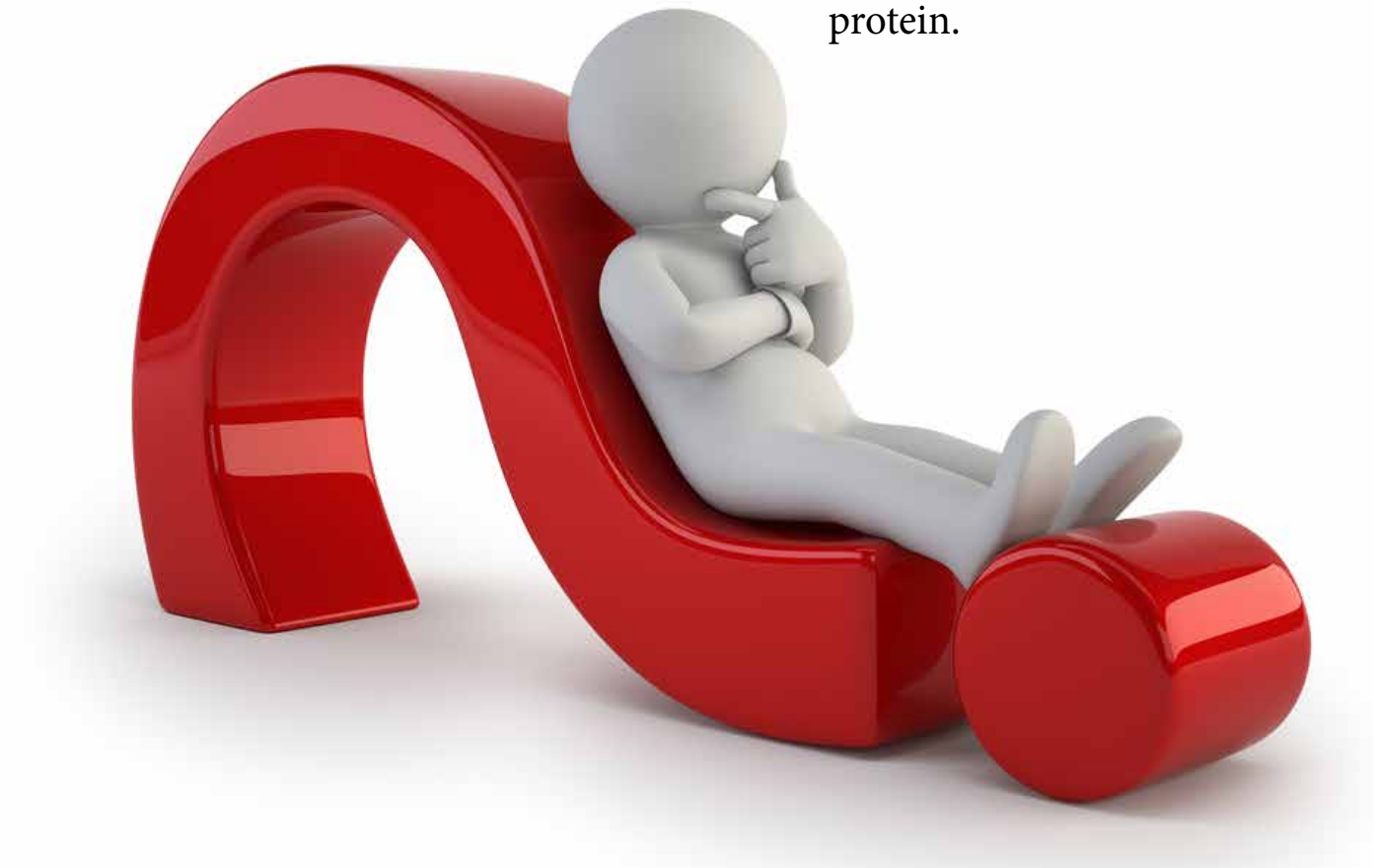
Before 2008 - Nothing can escape a black hole: *Wrong*. Radiation particles DO escape a black hole constantly, but they have no physical information, almost like they don't exist as we think of existence.

This may be your attitude today: "I don't understand math and I never will. *Wrong*

It's okay to say "I don't know" and I love it when scientists say that. The honesty to say "we just don't know" gives great credibility to that person.

Predictions based on theories.....that's about the best we can do our side of our Earthly confines. Everyday we're told about a new study or research that completely reverses our previous notions on a subject, only to have it reversed again a month later. 10 years ago sleeping too little is bad for you. Last month, sleeping too much is bad for you and could shorten your life.

Caffeine is bad for you. Caffeine is good for you. 30 years ago: Eggs are bad for you due to excessive cholesterol. This year: Eggs are good for you. Your body naturally creates more cholesterol than eggs would and you need their protein.



Mankind has this insatiable curiosity to further our understanding of ourselves, our world and universe around us. Throughout history there have been theories that were considered "fact" for generations and were discovered to be false by those who "questioned". Some of their "facts" may seem ridiculous now, but it was only through human curiosity, exploration, and ingenuity that groundbreaking discoveries altered our understanding of everything.

Try to imagine several thousand years ago what it must have been like to try and comprehend what all of those pretty shiny lights in the night sky were. It makes sense that many "primitive" cultures revered stars as deities or at least objects of religious importance.

Given the technology of 600 B.C. the observation that the sun appeared to "move" around Earth is not really that far-fetched of an idea...that Earth was the center of the universe.

This idea of an Earth centered universe was widely accepted until the 1500's when a man by the name of Nicolas Copernicus went against this idea that had been considered fact for hundreds of years. He developed the heliocentric (spiral) model for our solar system. The reason he is most credited with the heliocentric model is due to his total inclusion of mathematics and physics together to formulate theories.

Copernicus still feared persecution. His works titled "De Revolitionibus Orbium Celestial" were not published until the day of his death in 1543. Because there was nobody to persecute, it was passively accepted until banned in the year 1616. It wasn't until 1835 when the support for the theories written by Copernicus had become seriously considered that the ban on the book was lifted. While much of the groundwork from his discoveries had been laid down years beforehand, Copernicus was the first to write the theory in such a complete way, combining many different scientific disciplines.

It is clear that our curiosity, and our wonder of the world around us leads to the advancement of knowledge.

Edwin Hubble (Hubble Telescope), allowed us to observe an increase in the wavelengths of radiation coming from an extraterrestrial sources. The significance was that Hubble was actually able to observe relatively close nebula. It wasn't until Hubble had applied the theory of relativity to his equation that he considered the influence of gravity.

Without constant movement and expansion, he considered that the

The Veil Nebula -- the supernova remnant of a star that exploded 5,000 to 8,000 years ago -- as captured by the Hubble telescope

universe as we know it might collapse in on itself, which just so happens to be a recent theory of serious consideration, (the Big Crunch Theory). Edwin Hubble was a lawyer by the way, who became fascinated with astronomy and lead us to today.

Every generation is a little less restricted than the prior due to ever changing technology and social acceptance. Even now in 2016, some of Einstein's theories and Sir Isaac Newton's theories are being called into question. It's not that they are "completely" wrong, but not completely correct, needing slight modifications or tweaking for the moment to make them work.

One thing is for sure....this too will continue to change and the facts we learn in school today will be called into question as they are replaced with new theories which cannot be proven either.

Exploration, discovery, theory and opinion about the nature of the universe, our planet, the human body, brain and society itself zoom ahead as never before, so we must logically and responsibility question what is fact versus theory and then question the theory.

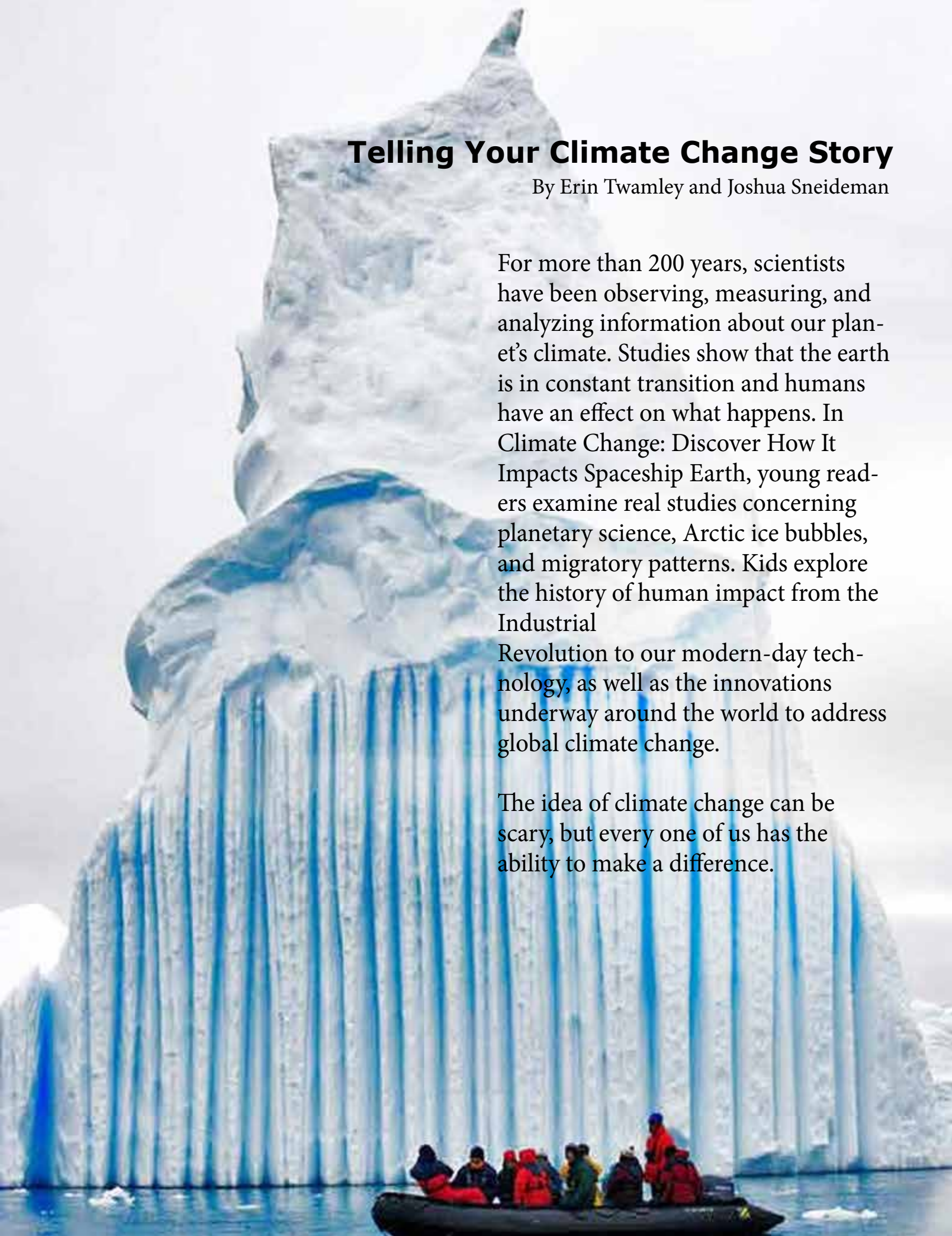
The more we discover, the more questions arise. Most questions regarding the universe will never fully be answered correctly but these questions must be asked and considered and there is a good chance that we will be wrong.

It's okay to say "I don't know", but it's critical that you question.

Why question?

YOU will lead the way, as you question current opinion and theory, to new and interesting concepts and investigations that will replace many current positions on the nature of the universe, the functions of the human brain, global economics, renewable energy, the nature of the world around us and most importantly.....what is possible.

I can guarantee that much of what you think is fact right now, will be replaced, or modified and you will be the one who does it.



Telling Your Climate Change Story

By Erin Twamley and Joshua Sneideman

For more than 200 years, scientists have been observing, measuring, and analyzing information about our planet's climate. Studies show that the earth is in constant transition and humans have an effect on what happens. In Climate Change: Discover How It Impacts Spaceship Earth, young readers examine real studies concerning planetary science, Arctic ice bubbles, and migratory patterns. Kids explore the history of human impact from the Industrial
Revolution to our modern-day technology, as well as the innovations underway around the world to address global climate change.

The idea of climate change can be scary, but every one of us has the ability to make a difference.

COP21 is a fairly simple concept and can be explained like so: Countries from all over the world are going to meet up in Paris at the end of this month and try to decide the best way to keep the world from getting any hotter.

COP21 just ending and the first ever Global Climate deal the time to #ActOnClimate is now. There are over 200 World Leaders, including oil rich countries like Qatar and Saudi Arabia all agreeing to #ActOnClimate for a better future. The world's richest people led by Bill Gates are agreeing to invest billions of their own capital into renewable technologies in an endeavor called the Breakthrough Energy Coalition.

Around the world, nearly 100 billion dollars are being invested by the Green Climate Fund, (http://www.greenclimate.fund/contributions/pledge-tracker) a group of 100 countries including the two biggest carbon emitters in the world, (USA and China) pledging to make drastic greenhouse gas reductions by 2030. All of these actions are helping us to reduce our fossil fuel consumption and carbon future.

Now, what the world needs more than ever is individuals to #ActOnClimate. Why? Because individual acts of green can add up to a powerful change. We must let our voices echo. Here are 5 tips to help tell your climate change story. Join the movement. Your voice is important.

1. Use stories about innovation to start a positive climate change conversation. Have you ever seen an invention that just blew your mind? Something so cool and futuristic it made you go wow. Share that with others. Was it an electric car or a massive wind farm? The inventions we see on TV, movies or in

everyday life are helping to change our planet.

2. Take a snapshot. Show people how climate change is impacting you, your family, friends or even community. Photos can often send a quick and

powerful message. Make sure you to capture positive images -- like those awesome inventions you see.

3. Read other perspectives. Climate change impacts communities around the world. But how it impacts us may look different. Look for areas that are impacted today. See for yourself that climate change is happening now. It is important to read and learn about what communities are doing from Brazil to Norway or even China on climate change.

4. #Youth4Climate. Join the movement online (with permission of an adult of course!). Twitter, Facebook, Instagram and Snapchat are all good places to engage with youth about climate change. Make sure to keep it positive and use hashtags like:#Youth4Climate #climatechange #cop21 #globalwarming #parisagreement.

5. Act Local. It is a big world out there. But what you do in your home, school or community can make a difference. Walk or ride your bike to school (with permission of an adult of course!). Do an energy survey in your school or home to find out how much you are actually using and find ways to lower it.

Erin Twamley and Joshua Sneideman are educators and authors of two STEM books for middle school students, Climate Change: Discover How It Impact Spaceship Earth and Renewable Energy - Discover the Fuel of the Future. Josh was an Albert Einstein Distinguished Educator Fellow at the U.S. Department of Energy and has 10 years experience as a middle school science teacher. Erin has led energy literacy and STEM efforts for government agencies and loves to travel the world and currently lives in Seoul, South Korea.

Computational thinking is a way of solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science. To flourish in today's world, computational thinking has to be a fundamental part of the way people think and understand the world.

drug-resistant strains of diseases. Artists, when given the tools to think and express themselves computationally, can create totally new modes of human experience.

Users of the Internet, when empowered with computational thinking, can demystify privacy technologies and surf

What is computational thinking?

Computational thinking means creating and making use of different levels of abstraction (the act of considering something as a general quality or characteristic, apart from concrete realities, specific objects, or actual instances), to understand and solve problems more effectively.

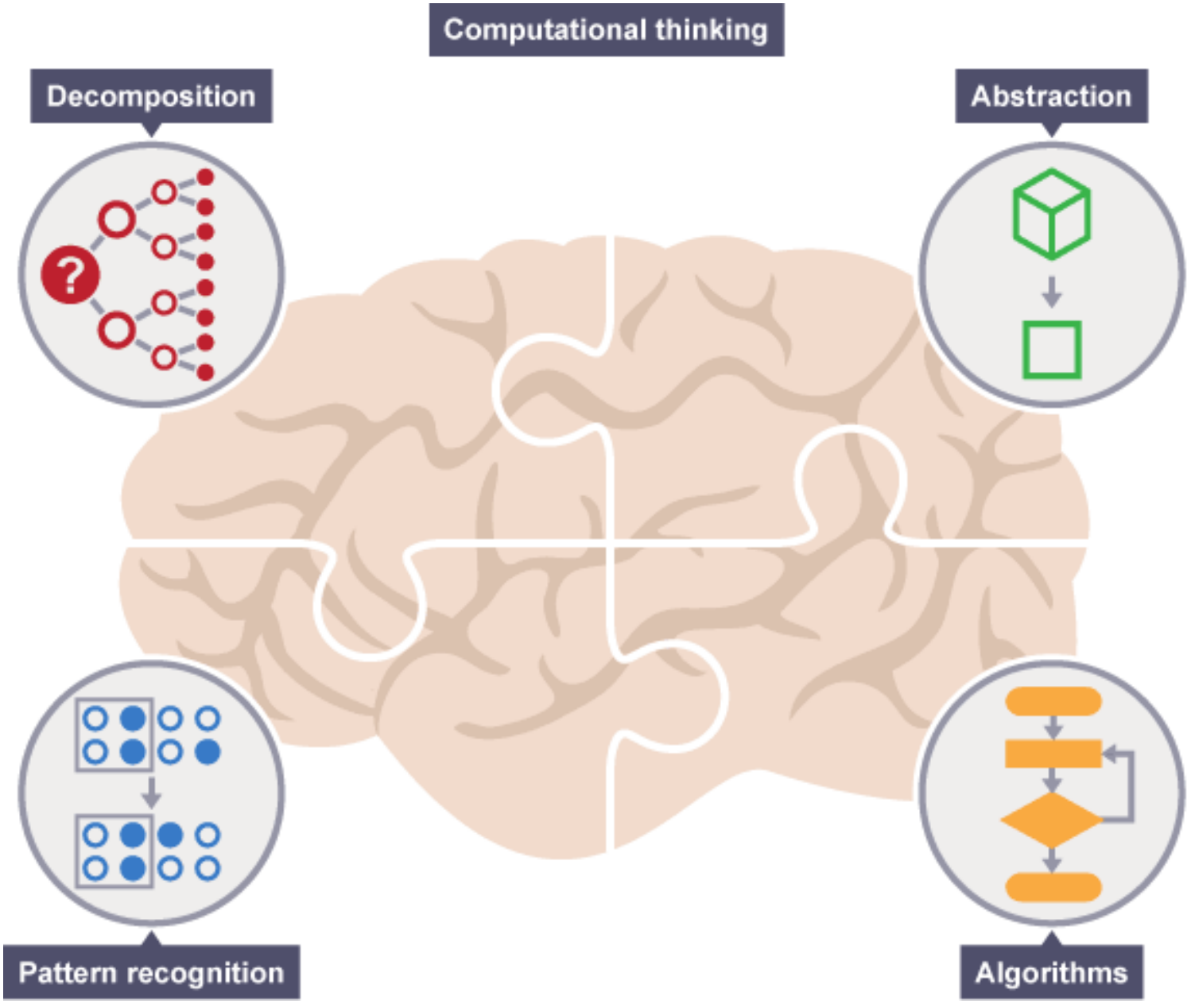
Computational thinking means thinking algorithmically (a set of rules for solving a problem in a finite number of steps, as for finding the greatest common divisor) and with the ability to apply mathematical concepts such as induction to develop more efficient, fair, and secure solutions.

Computational thinking makes it possible for transplant surgeons to realize that more lives can be saved by optimizing the exchange of organs among pools of donors and recipients. It enables new drug designs to be analyzed so that they are less likely to create

the web safely.

These and several other possibilities are being realized in the Center for Computational Thinking at Carnegie Mellon University through a collection of PROBlem-oriented Explorations.

Working closely with Microsoft Research, PROBEs explore specific opportunities to demonstrate the power and value of computational thinking in a wide range of domains. The vision is that computational thinking is for everyone, not just computer scientists.



http://www.cs.cmu.edu/~CompThink/probes.html

Law *makes STEM education a priority for nation's K-12 schools*

ESSA, the new federal K-12 law, looks at what the law will mean for virtually every aspect of public schooling when it takes full effect in the 2017-18 academic year.

The law has nearly 100 references to STEM, and the bill's authors clearly sought to incorporate STEM as a national educational priority. Among STEM education highlights, the law:

- provides funding through grants to the states for STEM education engagement, courses, after-school programs, service-based and field opportunities, and other activities;

- professional development and instructional materials for STEM teachers; and the creation and enhancement of STEM-focused specialty schools;

- allows schools to partner with institutions of higher education for professional development for teachers, including in STEM;

- establishes a nationwide STEM Master Teacher Corps, a state-led effort to recognize, reward, attract, and retain outstanding STEM teachers, particularly in high-need and rural schools;

- retains the No Child Left Behind requirement that states must test all students in science, once each in elementary, middle and high school;

- retains the requirement that states must test all students in mathematics in each of grades three through eight and again in high school; and

- retains mathematics and science, and adds computer science, as core academic subjects that are part of what constitutes a "well-rounded education."

Notably, however, the bill does not renew the Math and Science Partnership (MSP) Program, a DOE grant program created in the NCLB law that funds collaborative partnerships between STEM departments at institutions of higher education and high-need school districts. It is not yet clear whether the MSP program will continue at the DOE without authorization,

but the Department should still be able to fund such partnerships under the new law even without a formal MSP program.

The STEM Education Coalition, an alliance of more than 600 business, professional, and education organizations, supported the legislation that later became law in an early December statement. The Coalition pointed to the STEM provisions included in the agreement:

"We are encouraged that the Every Student Succeeds Act retains math and science testing, creates a STEM Master Teacher Corps, will provide much needed professional development training to STEM educators, and would allow greater access for thousands of school districts to federal funding to support STEM programs and activities, including partnerships with nonprofits. The bill also continues afterschool and informal STEM activities, encourages alternative certification programs to allow more STEM teachers to come from industry, will retain and provide promising STEM teachers with differential pay, and provides critical support for leadership training and mentoring to strengthen instruction in STEM fields."

The Physical Sciences Education Policy Coalition (PSEPC), a smaller group that includes AIP and a number of AIP member societies, including the American Association of Physics Teachers, the American Astronomical Society, the American Meteorological Society, the American Physical Society, and The Optical Society, also endorsed the bill in a letter sent to every member of Congress. The PSEPC letter concluded:

"The conference agreement embraces STEM education in both spirit and through considerable financial support, and in our estimation this bill would contribute to the broader national effort to ensure the U.S. maintains its competitive edge internationally in the STEM fields, which drive innovation and economic growth."

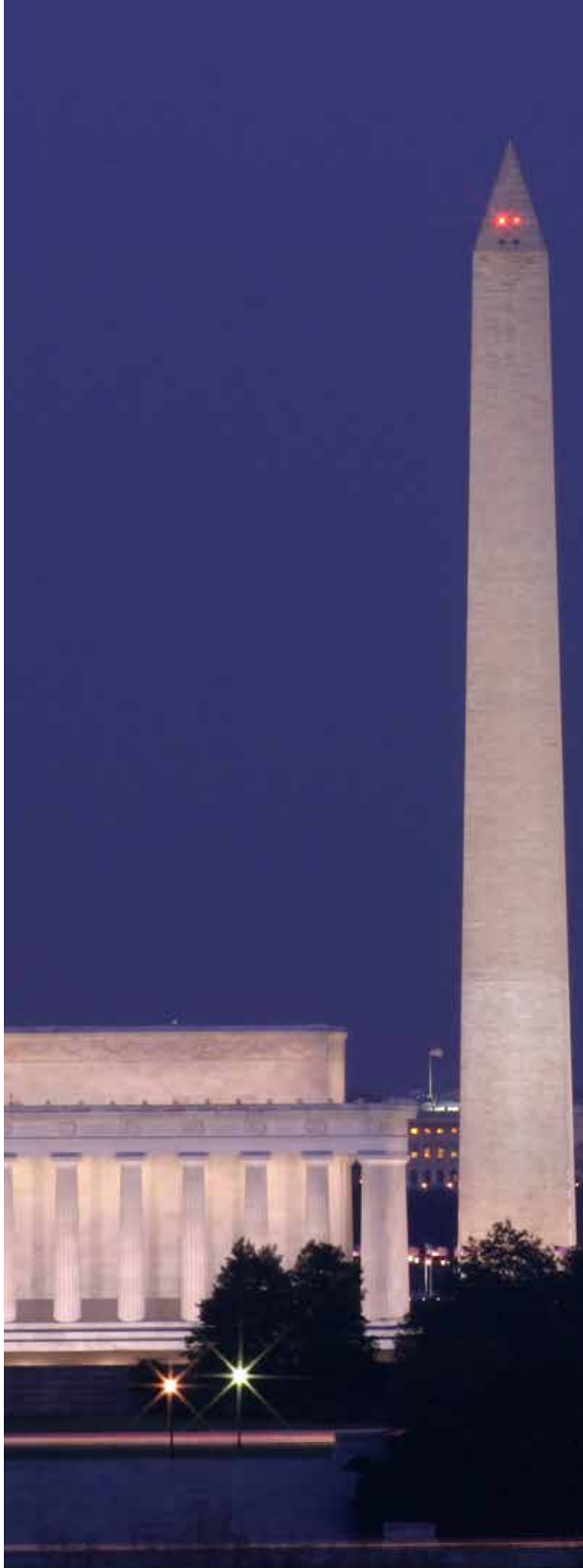
The acting Secretary of Education John King Jr., in collaboration with the states, is now responsible for taking the steps necessary to implement the new law, with authorities through 2020.

President Obama released a report to accompany the bill signing that summarizes the progress the country's schools have already made since he was elected to office, including reaching over halfway to the President's goal of training 100,000 STEM teachers in a decade.

The bill will likely be hailed as one of the top successes of the 114th Congress. Moments before the House passed the ESSA on Dec. 2, House Democratic Whip Steny Hoyer (D-MD) spoke on the floor of his chamber to spotlight the promise of the bill that is now a new law:

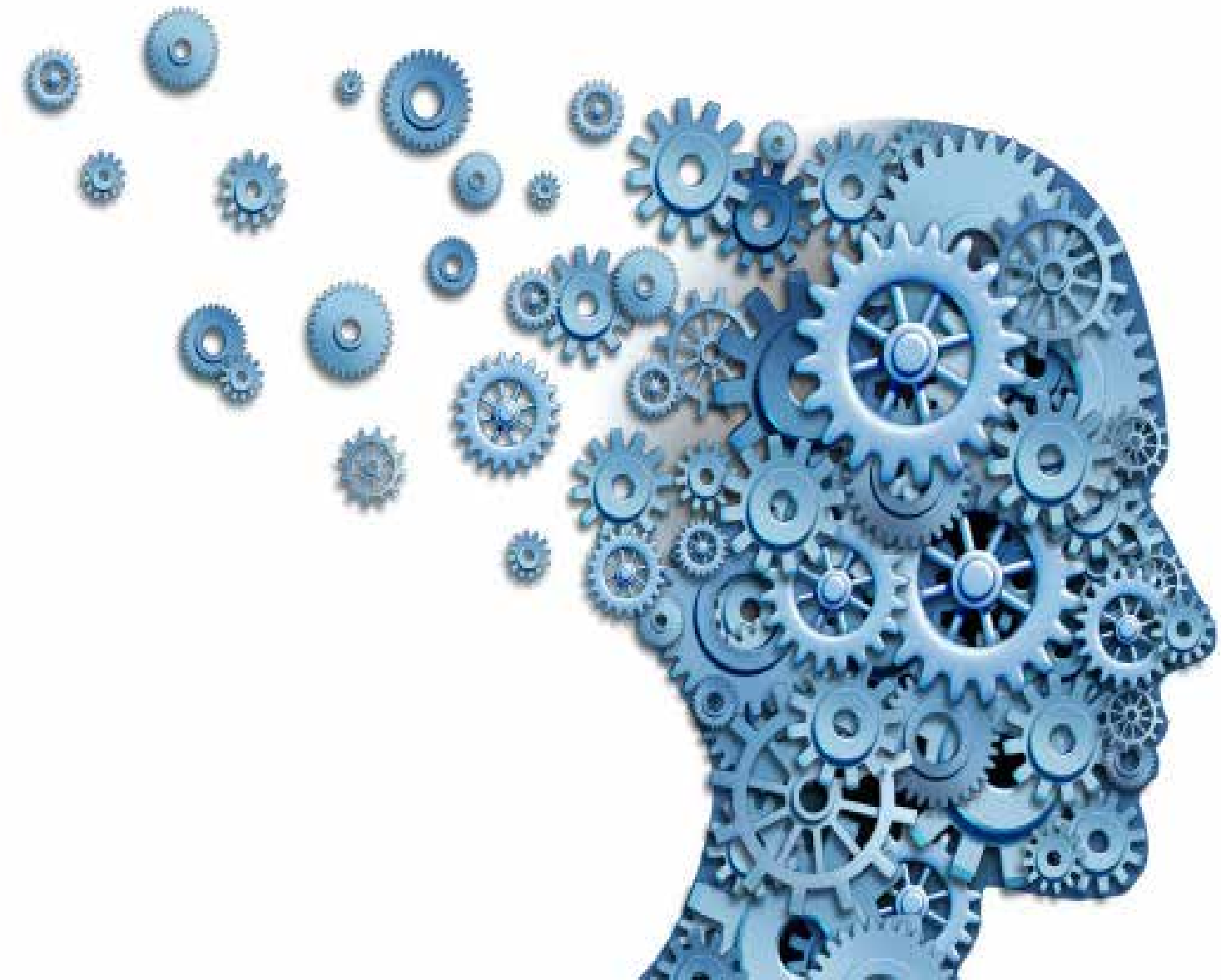
"It's not … perfect … but it represents a reasonable compromise that will strengthen elementary and secondary education in this country, provide certainty going forward, and help prepare the next generation of students – no matter who they are, how they learn, or where they live – for success in college, in their careers and their vocations, and as future innovators and entrepreneurs in our economy."

Michael S. Henry
Government Relations Division
American Institute of Physics



...Concept Memory is Brain-Constructed

Dr. Judy Willis



Under your guidance and through the opportunities you provide for students to use and transfer learning, their neural circuits expand the range of interconnections. As understanding builds, students' brains construct concept knowledge networks they will be able to apply to solve problems, adapt to new information, and collaborate successfully beyond the classroom and school itself.

Your support will be needed along the way. Just as learning how to walk, speak, and read does not emerge fully proficient, the construction of understanding and concept networks is not a smooth pathway to perfection. Going from the unknown to the known involves detours through uncertainty and mistakes.

Help students understand that setbacks provide opportunities for them to revise their brains' erroneous circuits and working through periods of confusion strengthens the accurate networks their brains ultimately construct.

Help students build their flexibility as a powerful support system for their emerging cognitive, emotional, and social mindsets and their tolerance for the growing pains they'll experience along the path to adulthood.

First Response –

Limited Perspective

Take a look at following examples and see if you can find a mistake in either.

There are mistakes in both! Perhaps you did see them, but most people do not see either the second "the" or the incorrect color of the 4 of hearts until they are pointed out. These are examples of in-attentional blindness.

Although the errors are clearly evident once they are pointed out, they are not initially perceived. In-attentional blindness regarding these examples is well within normal limits. However, the focus on single correct responses and specific "right" ways to solve problems has narrowed the perspectives of a generation of students.

When the brain repeatedly uses mental processing geared to rapid efficiency and single responses, it grows increasingly "successful" at this response to information and experiences. Students build the cognitive habits of accepting the first retrieved response as correct and the only accurate response. Learning experiences need to go beyond single answers and applications to push students to resist their first response as correct or as the only correct response. Brains that have become habituated to unthinkingly following direct instructions and memorizing single right answers may be restricted beyond in-attentional blindness.

Students without more expanded experiences interpreting data and developing solutions will not have adequate preparation for the rapidly expanding information pool in the globalized, technological world awaiting them when they leave school.

With accelerating quantities of information today's students face higher education and career challenges of interpreting, reasoning, communicating, and transfer of knowledge to novel applications. The repetition of facts is no longer adequate for being "smart".

The repetition of facts is no longer adequate for being "smart"

After years of passivity and limited responsibility for evaluating ideas, considering multiple options, or supporting their opinions, students must build the skills of constructing understanding, formulating ideas and clearly supporting their opinions or solutions with reasons.

Building Cognitive Flexibility;

Cognitive flexibility is one of the executive functions developing in the prefrontal cortex, especially during the school years. It is the capacity to be open and receptive to considering all aspects of an experience, sources of information, a variety of interpretations, or approaches to problems. With well-developed cognitive flexibility students will have greater capacities to consider alternative points of view, predict a variety of outcomes, and assess changing data or new information from multiple perspectives.

Cognitive flexibility could increase the likelihood of being open to multiple interpretations, even when asked to respond with only one – such as finding the two errors in the sample diagrams.

Students can be paired with classmate(s) who have the same opinion on comfortable, interest-related topics that do not require formal evidence. They share reasons for their opinions and select one or two that they feel are most convincing. Groups then expand to four to bring together student pairs with their different opinions and reasons to discuss with each other.

Topics, depending on student age, could include might include opinions about the best: bedtime story, breed of dog for a house pet, time to do homework, or Internet search engine.

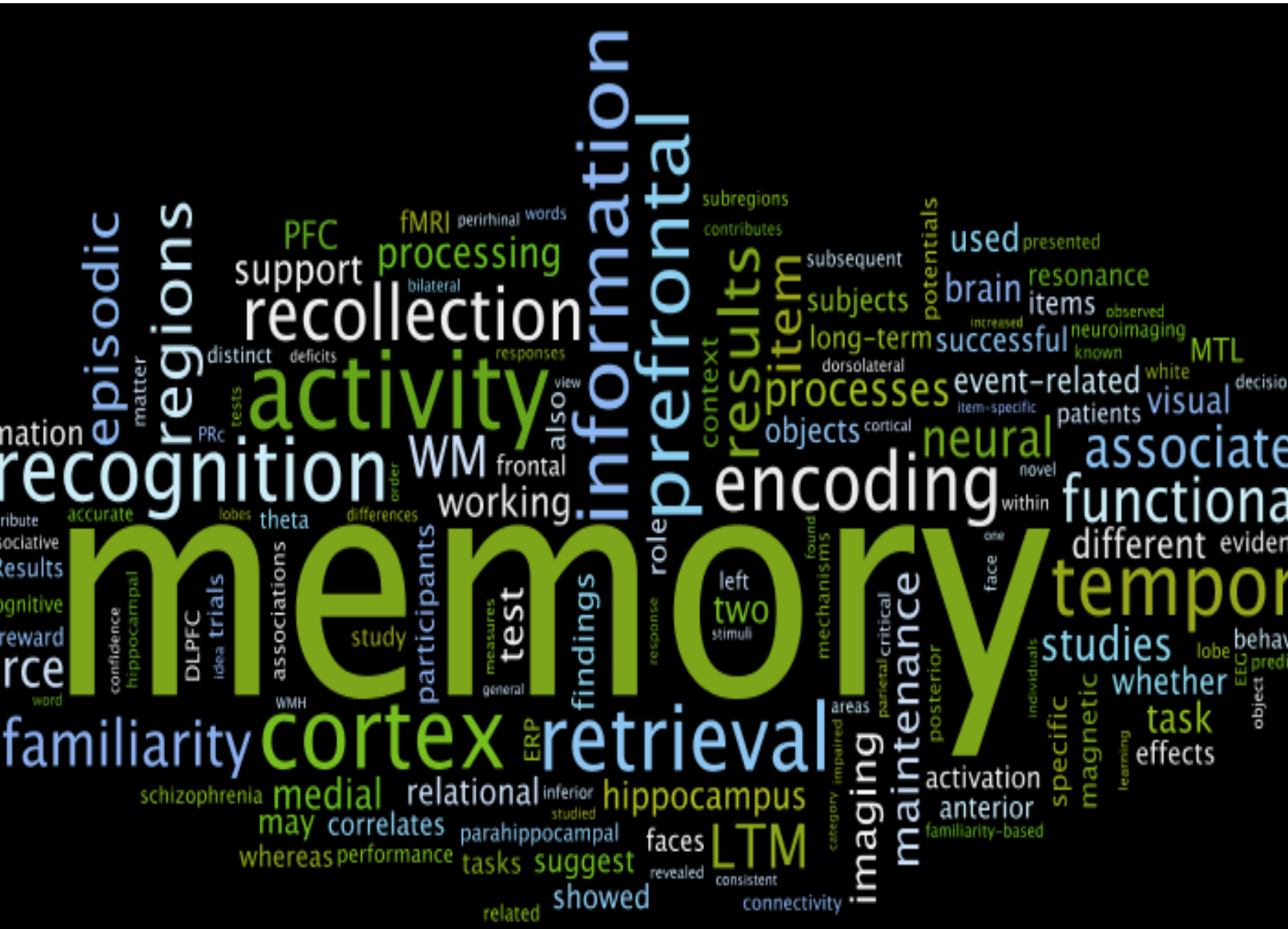
Active listening would be appropriate to include if students are not experienced in supportive and productive ways to exchange different opinions. (Active listening involves listening silently without interrupting, and then repeating back what one thinks the speaker said and inviting corrections of any misinterpretations.) As students build their opinion sharing flexibility, they can extend the discussions by each listener selecting one of the speaker's support reasons that seemed most convincing or reasonable.

Cognitive flexibility can be expanded in regard to media in a number of ways. In literature, students can reflect on reasons that an "evil" character in a story might not be fully to blame or deserves sympathy. Students can develop several different interpretations of art, music, a historical event, or an author's choice of literary devices. Even cartoons can provide opportunities for students to build cognitive flexibility when they are asked to think of several possibilities for, "Why do you think this cartoonist selected cows to be the talking animals with all the

other animals silent?"

Beyond having students develop multiple interpretations, they can be challenged to find more than one solution to a problem. The goal would be for them to build the habit of not stopping at the first "answer" that comes to mind. The problems could include historical disputes, ways to divide odd amounts of supplies equitably, several different endings for a story, improvements in rules for playing or scoring a sport, multiple ways to solve a math problem, or several ways to test a scientific hypothesis.

Teachable moments will become evident when you have cognitive flexibility in mind. When a student, novel character, politician, economist, critic, or analyst acknowledges a change of mind or opinion in response to considering alternative points of view or assessing new information, that can be an opportunity to acknowledge that person's flexibility, open-mindedness, fairness, or even courage.



Added Bonus

Basketball legend, Michael Jordan said:

"I've missed more than 9000 shots in my career. I've lost almost 300 games. 26 times, I've been trusted to take the game winning shot and missed. I've failed over and over and over again in my life. And that is why I succeed."

As students develop cognitive flexibility watch for additional expansions in their habits of mind.

Making mistakes will be recognized as an opportunity to increase understanding and not an indication of failure. You'll see them build increased perseverance figuring out problems, improved skills of collaboration, and greater responsiveness to corrective feedback and making revisions.

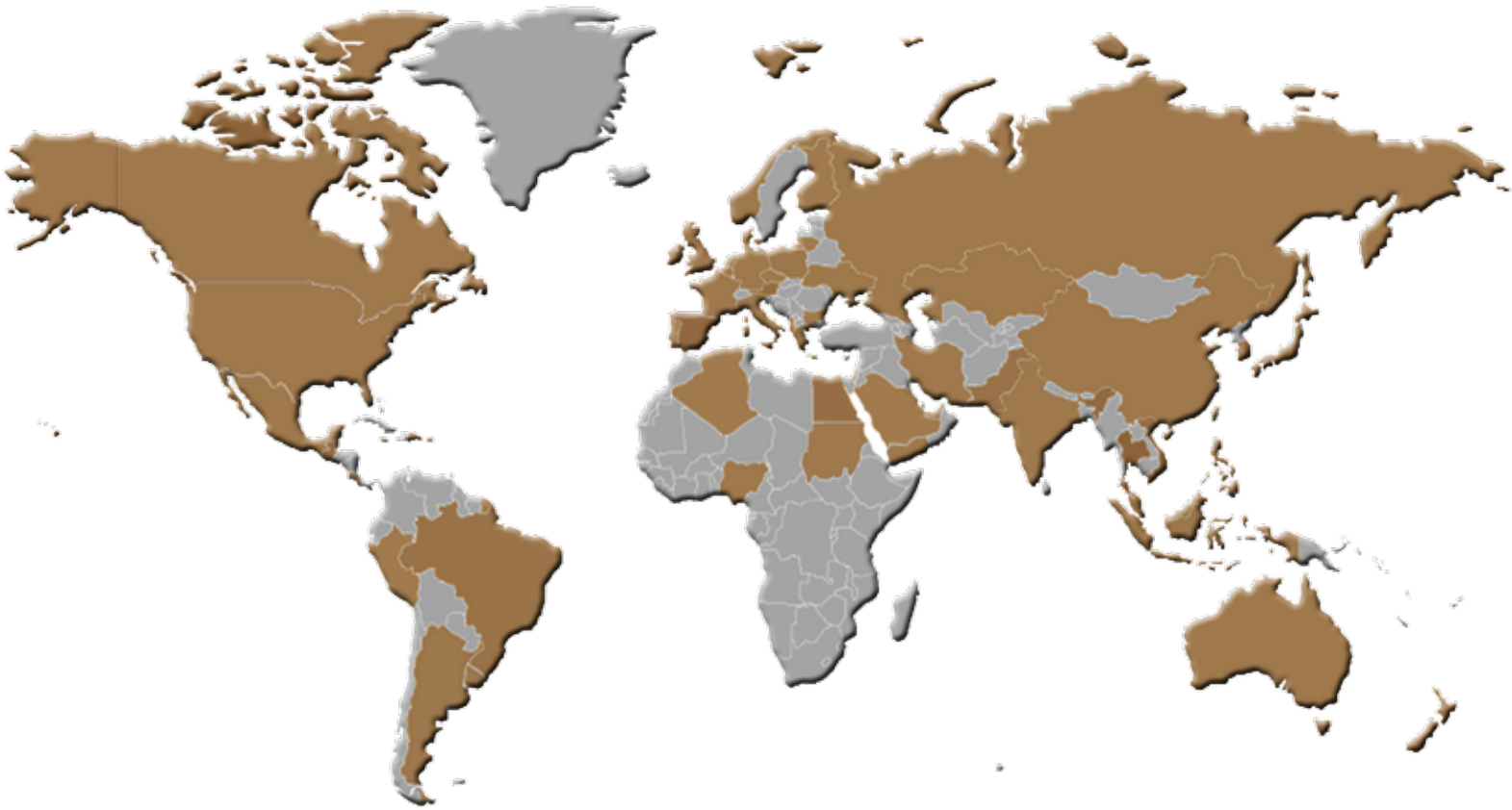
Best of all, consider the impact your efforts will have on your students' tolerance, ethics, and citizenship far beyond your classroom.

Dr. Judy Willis is an authority on brain research regarding learning and the brain. With the unique background as both a neurologist and classroom teacher, she writes extensively for professional educational journals and has written six books about applying the mind, brain, and education research to classroom teaching strategies, including an ASCD top seller, Research-Based Strategies to Ignite Student Learning.

After graduating Phi Beta Kappa as the first woman graduate from Williams College, Willis attended UCLA School of Medicine where she was awarded her medical degree. She remained at UCLA and completed a medical residency and neurology residency, including chief residency. She practiced neurology for 15 years before returning to university to obtain her teaching credential and master's of education from the University of California, Santa Barbara. She then taught in elementary and middle school for 10 years.

Dr. Willis gives neuroeducation presentations, and conducts professional development workshops nationally and internationally about educational strategies correlated with neuroscience research.

STEM Magazine is.....Global



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