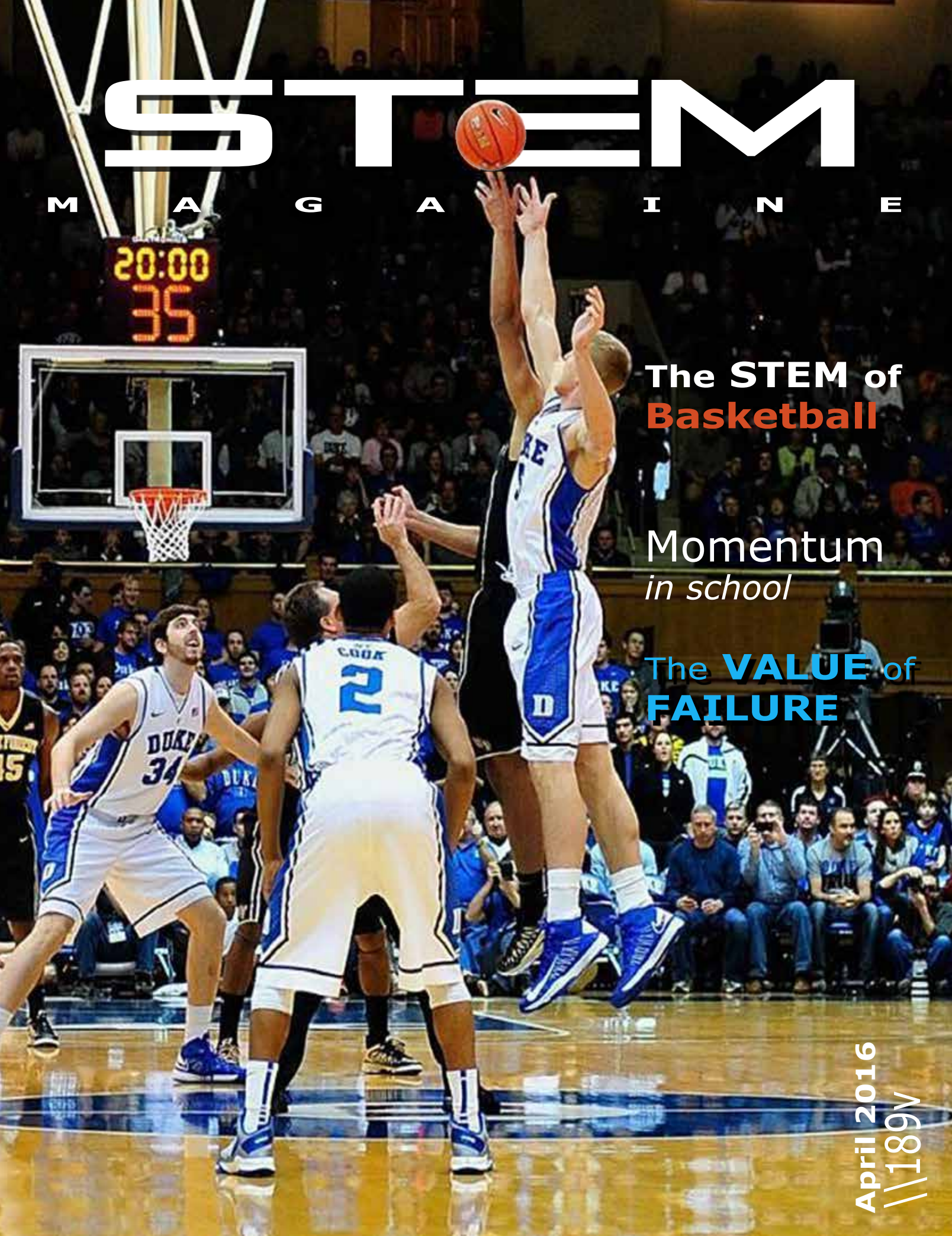
STEM

MAGAZINE



The STEM of Basketball

Momentum *in school*

The VALUE of FAILURE

April 2016
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STEM Innovations

A Math and Science Partnership Initiative in Northwest Indiana

Dear Educators,

As you rejuvenate over your breaks (or return refreshed for the last part of the school year) remember to mark your calendars for the following upcoming MSP events:

- ***April 13th-STEM Innovations Cohort II second follow-up session***: Cohort II participants CLICK HERE TO REGISTER

- ***June 13th-17th-2016 STEM Innovations Summer Institute***: 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.

On March 12th STEM teachers participated in a “Make and Take" workshop in which they formed working groups to design eco systems and learn about density and convection currents. Their learning related to density and convection currents was integral the understanding of plate tectonics and construction of earthquake safe structures.

The backdrop of the professional development related to the Engineering Design Process. Therefore, participants reviewed the elements associated with the process. This factored into the requirement that groups develop their model which was to include the problem, the criteria (requirements and constraints), the client, and the end user.

“Make and Take” content was designed so that teachers left with lessons related to 4 topics that can be used as independent classroom lessons or in combination depending on the desired outcome(s) of the lesson. Teachers used a variety of earth materials such as sand, lava rock, gravel, grass seed, horn worth, and snails. Two liter plastic bottles, small plastic cups, and standard cafeteria trays were among supplies used to build the earthquake structures. Additionally, science equipment such as Vernier probes and Low G Accelerometers tested the degree to which their structures would sustain an earthquake.

Teachers walked away with various lessons they can actually use in their classrooms by making modifications to fit their curriculum within their subject and grade level. It was a successful “Make and Take” professional development day!

The STEM Innovations design team is finalizing directions for upcoming offline assignments and professional development activities. Watch your emails for further instructions.

Your STEM Innovations Team

MERRILLVILLE COMMUNITY SCHOOL CORPORATION

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.

Wayne Carley
Publisher
STEM Magazine

wayne@stemmagazine.com

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Contents:

STEM Magazine is a non-profit monthly education publication for teachers, students, their parents. The example and inspiration of individual educators carries tremendous weight on a daily basis, greatly impacting the quality and effectiveness of the classroom environment.

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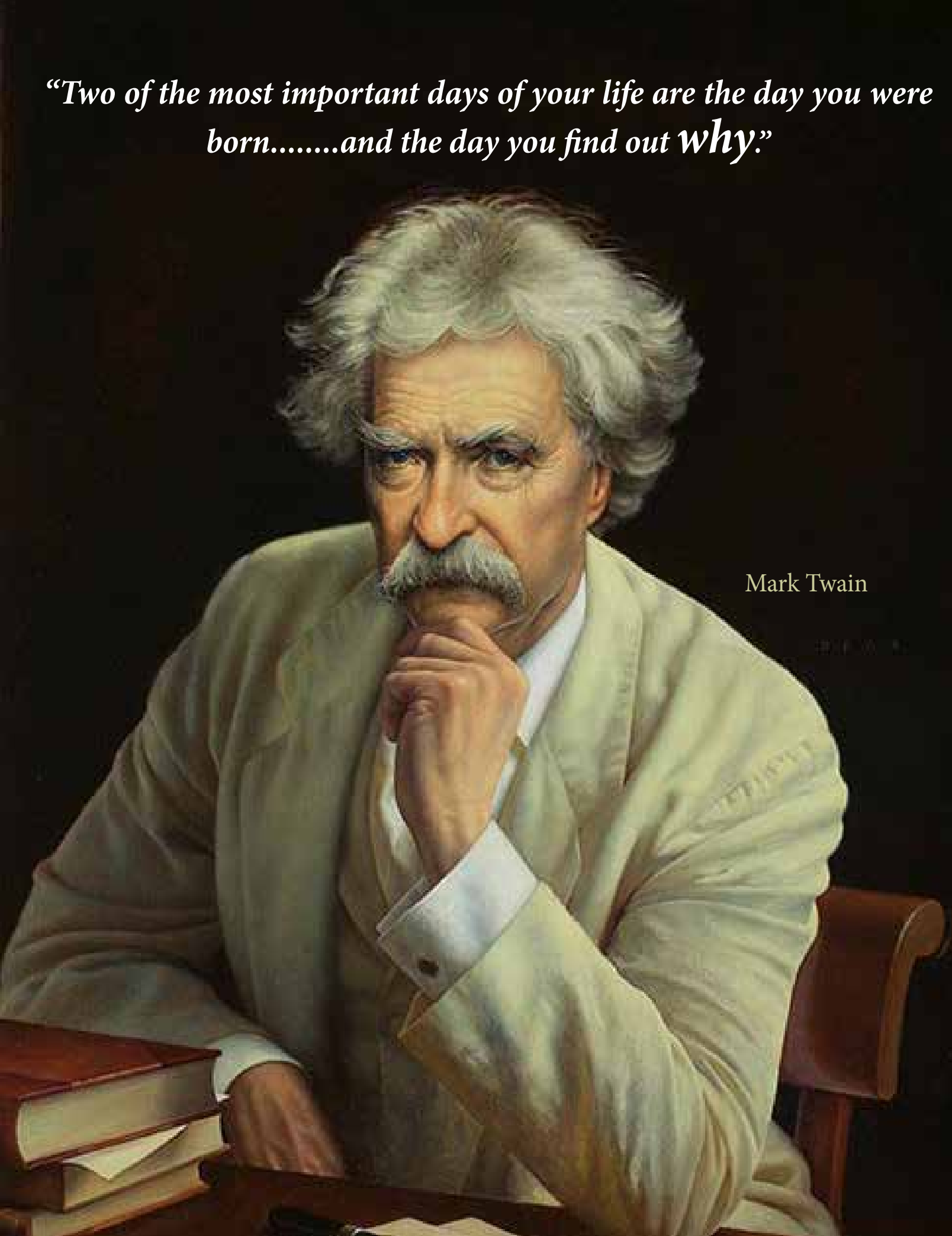

"Two of the most important days of your life are the day you were born.....and the day you find out why."
Mark Twain

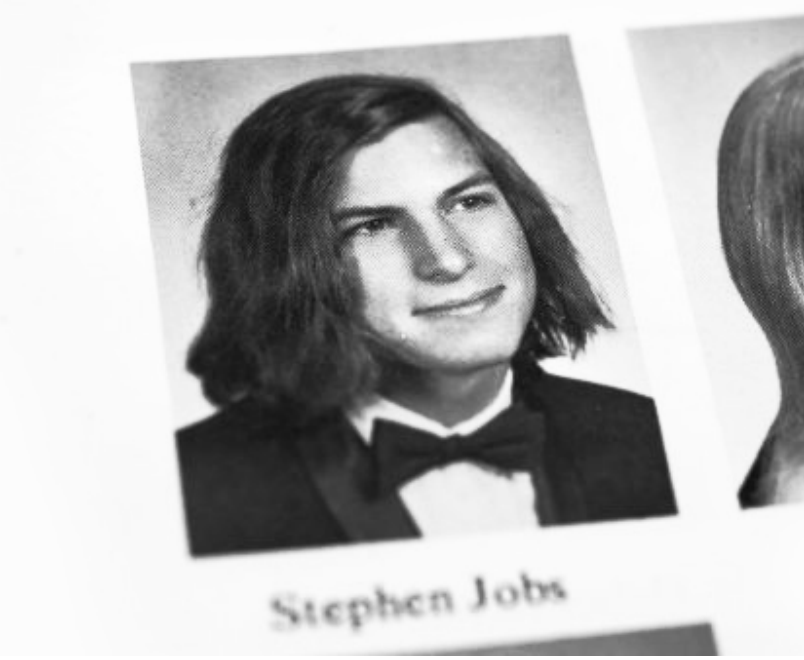
Testing versus Passion: *The value of failure.*

by *Lauren Martin*

I've never been asked in a job interview what I got on my SAT's, but EVERY interview (resume) asked, "What experience do you have?"

When you die as a billionaire who created one of the most influential companies in modern history, people automatically assume that you were pretty smart. And smarts mean good grades in school, right? That's what your teachers want you to believe. Mr. Stephen Paul Jobs was a genius, but not at getting As on his report card.
It's common knowledge that Jobs was a college dropout. He left Reed College after only six months and ended up getting a job as a low-level technician at Atari. He would then go on to create the Mac with Steve Wozniak, and the rest, as they say, is history.

The Atlantic magazine did some digging through Jobs's recently released FBI file and found a great nugget of history: his high school GPA. During his years at Homestead High School (1968-1972), Jobs averaged a 2.65 GPA, meaning he got mostly C's and B's. So he wasn't a bad student, but definitely not the scholar you would expect from a future industry titan.



For all the students without a 4.0 grade average, especially those with a C average or worse, don't be discouraged. The test's that really count are still to come. After years of inadequacy and a feeling of "average", your time has come. Even if your GPA's lower than 1.2, you can be great.

For years, society has placed a disgustingly large stigma on bad grades and an overwhelming importance on good grades, both in the U.S. and global comparisons. There's a predisposed instinct to strive for A's and cast anything lower to the side, to deem as unworthy. Well, it's time to let the children learn that it's okay not to be an A student, it's okay to fail from time to time. Here's

a little secret the older generations are unwilling to divulge to you: it doesn't really matter.

For all those years that you spent cooped up in the library, poring over facts and stats, soliloquies and Greek mythology, the average scoring kids — the ones getting C's in college — are the ones obtaining the skills that do matter: life experiences. Failing is a life experience.

you about your GPA or how you did on that Psych 215 final. What matters in the real world is your ability to adapt, innovate and get along. There are no scantron sheets or essay exams.

The greatest thinkers, leaders and entrepreneurs of our time have been the men to defy the rules and take risks. They were the ones getting C's or flunking out. However, their "failures'

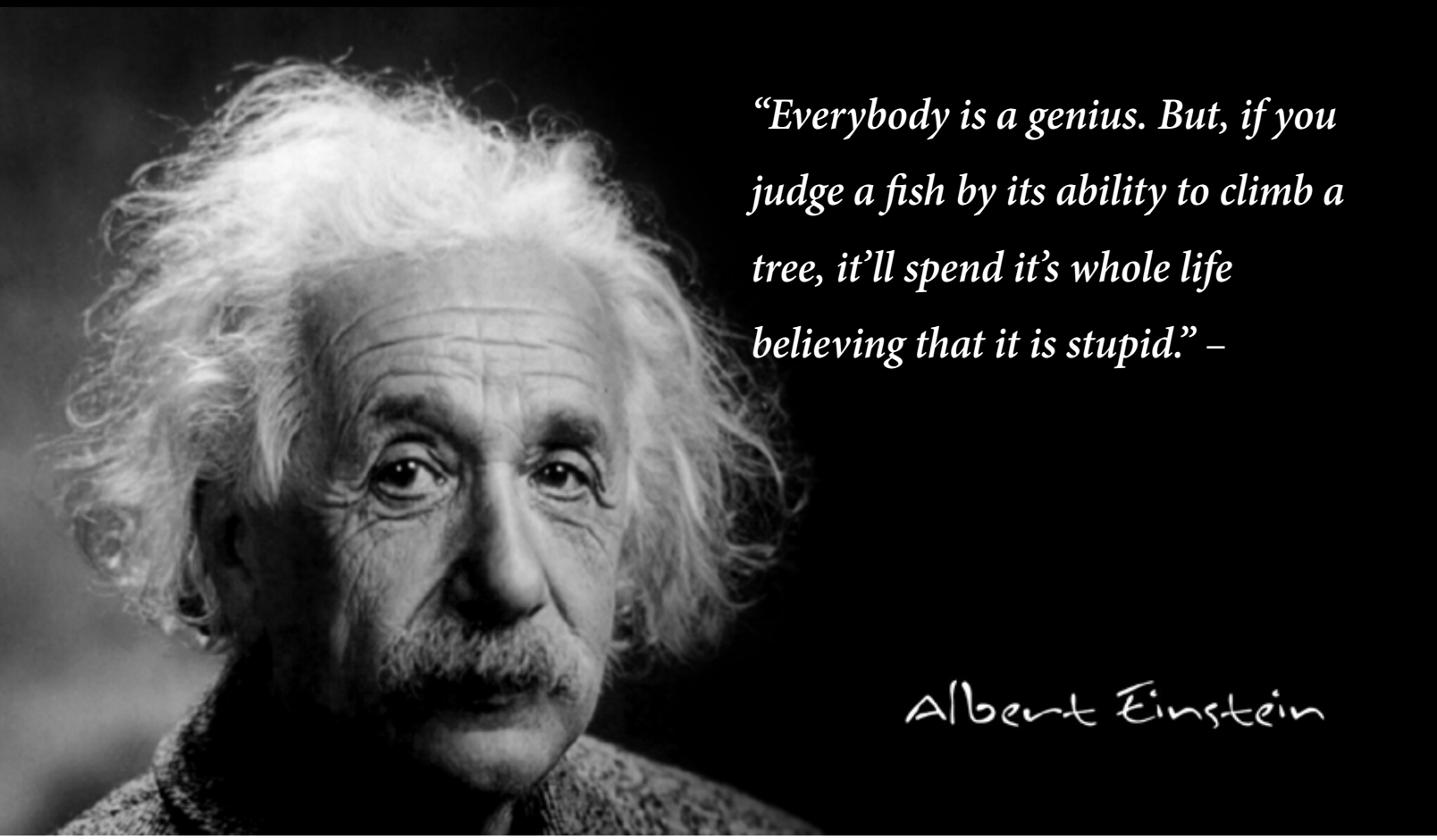
"Success consists of going from failure to failure without loss of enthusiasm."-Winston Churchill

Not getting that A on the exam you spent all night studying for, is an experience. Life experiences are a composite of all the skills necessary to get along in the real world. It's comprised of all those skills that are only learned through failure and the obstacles of life, like how to hold a conversation, get away with a lie or entertain someone you really don't like. It's all those skills that high-paying Fortune 500 companies value above all else.

In college, it's all about grades. In the real world, it's about experience, and drive. Because once you get past the first job, no one is ever going to ask

were not a factor of intelligence, but an inability to be weighed down by grades and superficial markings. Bill Gates, Steve Jobs and Richard Branson, are just a few of the men who achieved unfathomable amounts of wealth, status and success without ever really succeeding in a classroom. They are the men, that by society's standards, had failed.

With their passion and intelligence, they were able to change the world with nothing more than a bachelor's degree and a transcript of failing grades (sometimes not graduating at all). These men understood at an early age



that just because society, and everyone around them, placed an excessive amount of importance on grades didn't mean they were right.

But it's not just these extreme examples of eccentric billionaires and tech geniuses that should solidify the results of this finding. It's about yourself and the gut feelings you have towards what is right and what is wrong. Succeeding in life means following your gut and understanding what a bad decision is. Just because you passed American History with flying colors doesn't mean you'll know what to do when your coworker is talking behind your back to your boss. It doesn't mean you'll know how to handle an insubordinate or get together a presentation the night before a deadline.

The people who do great things are the ones too absorbed in their own ideas to place too much weight on the opinions of others. Why should Steve Jobs spend hours studying someone else's ideas and breakthroughs when he could be out creating his own? What people fail to see in bad grades is the reason behind them.

Why is this person not getting an A?

Is this person doing something that is better?

So for all of you preparing for finals, or finishing them with a bitter taste in your mouth, this should be reason enough not to worry. If you are ending the semester with C's and maybe a few D's, don't sweat. There's plenty of opportunity out there, and it's the people with the audacity not to care about their grades — the ones who don't spend their lives in the library and bubbling in correct answer sheets — who will rule the world. Because at the end of it all, it's really about those people with the most passion.

Basketball

IS a S.T.E.M. career.....

making the coach a S.T.E.M. teacher.

I'm not sure how many coaches are going to read this, but see if you can get yours to.

Some coaches teach another traditional class which includes them in the S.T.E.M. conversation, but sports in general has a fascinating and deeply complex S.T.E.M. exercise happening at lighting speeds in the brain of our kids. S.T.E.M. and sports just may be the best example for them to grasp the concepts of personal integration and awareness.

The Basketball-

A basketballs outside covering is made of synthetic rubber, composition leather or pure rubber. The inside part is a balloon-like structure which holds air and carcass or leather covering. The bladder is made from a butyl rubber, while the carcass is made of threads of nylon and polyester.

The amount of air pressure within the bladder determines its bounce and responsiveness which affects everything about how we use it. The type of flooring (wood, concrete, pavement, synthetic) determines how the ball will bounce, thus effecting all other aspects of the interaction of playing.

This construction is of scientific origin and uses a variety of man-made materials produced in the lab: ***thus a science career.***

Careers in chemical engineering, composite research, aerospace materials, and new applications of old technologies are just a few of the job possibilities available to our students.

Some of the most interesting research and development revolves around Nano Technology that creates new molecules and combinations of molecules on a microscopic scale to produce what we now know as carbon fiber, Kevlar, and others that are revolutionizing every aspect of our sports and society.

Don't think for a moment that we've discovered or created all there is, so I get very "curious" about what our students will discover, create and apply that will make the materials and technology of 2014 seem antiquated.

As basketball materials evolve, the science behind playing the sport will have to evolve also. How we run and dribble today may be different in 3 years because of the energetic response of the materials integration. Just look how our basketball shoes have changed.

Dribbling-

As I push down or let the basketball fall with gravity, my brain instantaneously and mathematically calculates the amount of energy in my shoulder, arm, hand and fingers necessary to have the ball bounce all the way back up to my hand.

Based on the results of the first dribble, math and energy adjustments are instantly evaluated and adjusted as necessary for the next dribble. This process continues throughout the dribbling process which may include 50 dribbles down court.

All of this happens subconsciously, instantly and repeatedly. **Ask a basketball player if they like math. Whether it's yes or no, they should.**

This is the kind of S.T.E.M. integration needed for a student to understand its importance and wide range of applications. As a coach, why not bring this to the players' attention. That is the intigration we're looking for.....the link between S.T.E.M. and everyday activities that are connected to S.T.E.M. careers in general

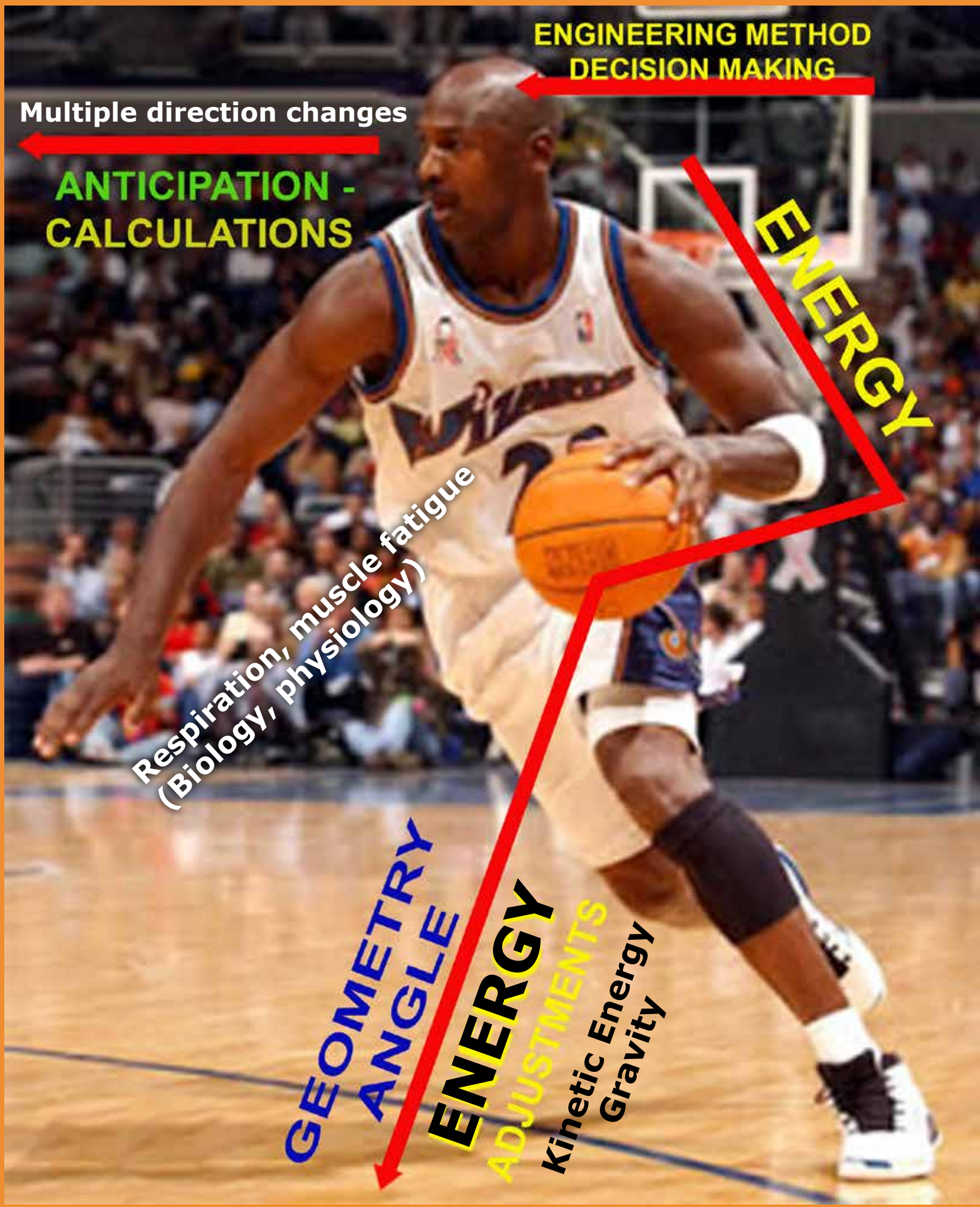
Running and dribbling-

It gets more amazing now as we incorporate the science of physiology, the study of the human body, and synchronize the act of *running* with all of its physical complexities added to the previously discussed math and science of dribbling. Now our math and science calculations must be modified due to our forward and sideward motions. We cannot bounce the ball down, but must instead push forward at a specific angle instantly calculated based on our speed and direction of running. The energy requirements to dribble will need adjusting as well to synchronize with our bodies motions.

This is so cool.

Mentally we have already begun to make math calculations regarding the process of passing or throwing the ball to another player which requires a completely new set of energy calculations, geometric angles from our present position to a calculated future position of team mates and estimations about outcomes. Keep in mind, our brain is making these math and science calculations while performing the dribbling process. ***Amazing.***

"Think of math as simply a natural function of what your brain already knows and uses."


ENGINEERING METHOD
DECISION MAKING
Multiple direction changes
ANTICIPATION -
CALCULATIONS
ENERGY
Respiration, muscle fatigue
(Biology, physiology)
GEOMETRY
ANGLE
ENERGY
ADJUSTMENTS
Kinetic Energy
Gravity

Shooting a basket-

Now it gets fun. When the player decides to shoot for a basket, some of the following takes place.

The player uses the engineering method (a decision making process) to determine which kind of shot they wish to attempt for the best result. Based on their instant conclusions, let's say a 3 point jump shot, they instantly visualize and estimate the distance to the basket and set in motion a complicated sequence.

Based on the distance to the basket, the player decides how high they must jump to overcome the defense (energy calculations), the amount of energy required for the hips, knees and legs to reach that height with an estimated knee bend. A quick evaluation of their physiology (science) determines their ability to perform that task (maybe due to a bad knee or tall opponent). The player must estimate the amount of energy required to propel the ball the required distance, taking into consideration the geometric arc of the ball (math) to reach the basket with either a back spin on the ball or flat shot.

The brains of your players are using physics, geometry, engineering, science, biology, and physiology to name a few without knowing it and possibly without ever having taken the classes. They were born with it.

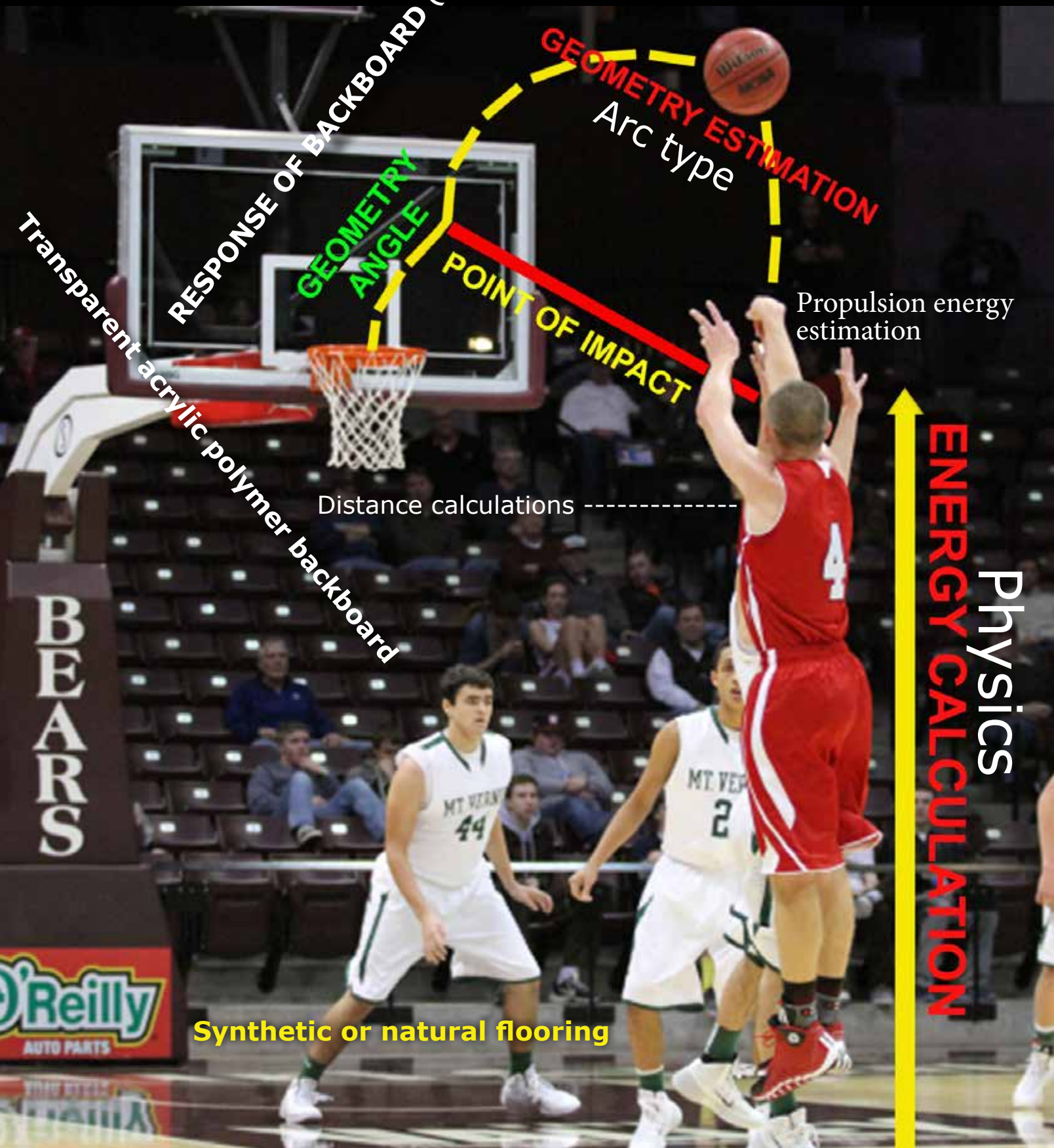
If a bank shot is required off the backboard, the geometry of the angle between where the ball strikes the backboard and deflects into the basket must be calculated. I'm exhausted just talking about it.

The point is, we are wired for S.T.E.M. and the awareness of how we already use it daily should precede a new curriculum or additional classes.

Consider the fairly simple task of making our students aware of what they already do and how it's S.T.E.M. It makes the integration much easier, logical, necessary and even fun, building confidence and curiosity.....maybe even a better basketball player!

Is basketball a S.T.E.M. career? You decide.

Wayne Carley


RESPONSE OF BACKBOARD (SCIENCE AND TECH)
Transparent acrylic polymer backboard
GEOMETRY ESTIMATION
Arc type
GEOMETRY ANGLE
POINT OF IMPACT
Propulsion energy estimation
Distance calculations ----------
Physics
ENERGY CALCULATION
Synthetic or natural flooring
BEARS
O'Reilly
AUTO PARTS

Drones: Part I of IV

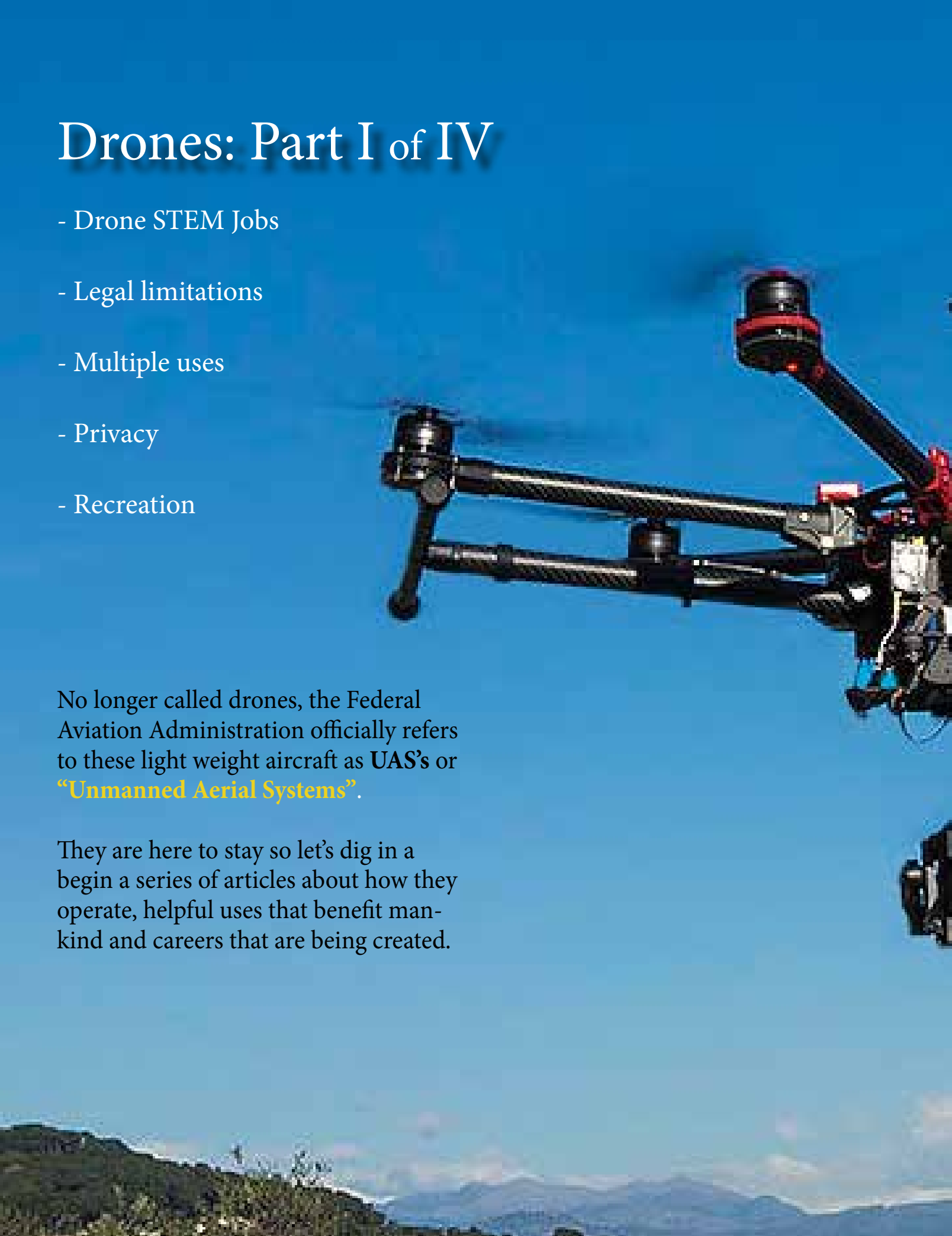
- Drone STEM Jobs

- Legal limitations

- Multiple uses

- Privacy

- Recreation



No longer called drones, the Federal Aviation Administration officially refers to these light weight aircraft as **UAS's** or **"Unmanned Aerial Systems"**.

They are here to stay so let's dig in a begin a series of articles about how they operate, helpful uses that benefit mankind and careers that are being created.

UAS's

For clarification, we will be discussing the typical consumer quadcopters, hexicopters and other custom made UAS's being developed world wide.

The are battery operated, remote control aircraft usually weigh less than 25 pounds. The most common and popular UAS weighs much less...maybe 5 pounds at most and are made of plastic, carbon fiber and composite materials to save weight.

Flight time is directly related to weight. The more a UAS weighs, the less time it remains in the air. The most popular recreational UAS made by DJI in China flies for about 15-20 minutes with a range of several hundred yards. Since batteries are heavy, you can't just add more batteries which would of course increase the weight and greatly reduce flight time. Also, as batteries are re-charged, they loose their life expectancy and quickly diminish flight time by minutes.

Let's do the math.

If I have a 10 pound UAS that flies for 25 minutes, and I add a camera that weighs 2 pounds, how many minutes of flight time have I cut off of my UAS?

Two pounds is 1/5 of 10 pounds, so I've increased my UAS weight to 12 pounds and reduced my flight time by at least 1/5.

One fifth of 25 minutes is 5 minutes, so my flight time goes down to 20 minutes.

The public is concerned that someone might try and add something dangerous to a UAS and fly it to do harm, but in reality, when you add "stuff" to the UAS, the flight time continues to drop dramatically.

Do the math for adding 5 pounds to your UAS. What is your flight time down to?

I have a large hexicopter I use for aerial photography, just like the one in the photo on the previous page. It weighs about 18 pounds with camera and battery. That is the maximum weight it will carry and still take off.

With each UAS, there are limits as to how much it can carry and still allow the electric motors to lift it into the air.

The most popular UAS on the market cannot take off if it's weight exceeds 3 pounds....it just won't fly. You could use larger motors, but they would need more electricity, therefore a larger battery and everything would weigh more. You have not gained anything.

My large UAS at 18 pounds with the most powerful battery available for that model will only fly for about 9 minutes. If it is windy, I loose 2 minutes. As the battery gets older, I loose another few minutes until it just won't fly anymore without a new battery.

These limitations of weight, power use, weather and altitude are a natural safeguard against many harmful uses.

Recreation / Travel

Most consumers purchase a UAS for fun, vacation photos, scenic photography, the thrill of flying something, or just for the novelty of it. With prices starting at about $500 for an air worthy model that has a descent camera and flight time, not everyone is running out to buy them, and when they crash..... most cannot afford to replace it.

Emergency Services

I see the UAS industry being most helpful when it come to providing eyes in the sky without the risk or cost of a helicopter. UAS's have already been used for search and rescue, surveying disaster areas from tornadoes and other tragedies.

The benefits and low cost of these tools have and will continue to save lives in the hands of trained professionals.

The video below is a great example of how a UAS could be used in a life threatening emergency where seconds make the difference between life and death.

These UAS applications are already being investigated and evaluated in countries around the world, laying the foundation for a wide variety of STEM careers and services that you may find rewarding. Remember, someone has to develop the software, electronics, materials and construction.

SAVING LIVES?

UAS ***Racing*** *(this is hot!)*

Specialized UAS (drone) racing leagues are popping up around the globe for a one of a kind sporting experience. These customized aircraft can hit 70+ miles per hour on the "closed course" with the latest in tech built in. Keep in mind, these have cameras on board for a racing view like none other.

Using video goggles linked to the on board camera, racers can fly like never before.

Imagine a first-person-view video game where you're racing through the air and dodging obstacles. Losing even one-tenth of a second can cost you the race. Now imagine that it's not a video game. This is the sum-total experience of first-person-view (FPV) drone racing. Drone racers see all the action from their drone's perspective as they weave through the air at upwards of 70 miles per hour.

UAS Materials and Careers

Carbon Fiber:

Also called graphite fiber or carbon graphite, carbon fiber consists of very thin strands of the element carbon. Carbon fibers have high tensile strength and are very strong for their size. In fact, carbon fiber might be the strongest material there is.

Each fiber is 5-10 microns in diameter. To give a sense of how small that is, one micron (um) is 0.000039 inches. One strand of spider web silk is usually between 3-8 microns.

Carbon fibers are twice as stiff as steel and five times as strong as steel, (per unit of weight). They also are highly chemically resistant and have high temperature tolerance with low thermal expansion. Carbon fibers are important in engineering materials, aerospace, high performance vehicles, sporting equipment, and musical instruments--to name just a few of their uses.

Because of its high tensile strength and lightweight, many consider carbon fiber to be the most significant manufacturing material of our generation. Carbon fiber may play an increasingly important role in areas such as:

Energy. Windmill blades, natural gas storage and transportation, fuel cells.

Automobiles. Currently used just for high performance vehicles, carbon fiber technology is moving into wider use. In December 2011 General Motors announced that it is working on carbon fiber composites for mass production of automobiles.

Construction. Lightweight pre-cast concrete, earthquake protection.

Aircraft. Defense and commercial aircraft. Unmanned aerial vehicles. Oil exploration. Deep water drilling platforms, drill pipes.

Carbon nanotubes. Semiconductor materials, spacecraft, chemical sensors, and other uses.

In 2005, carbon fiber had a $90 million market size. Projections have the market expanding to billions over the next several year. Those are jobs someone needs to fill. To accomplish this, costs must be reduced and new applications targeted. That's your job.

UAS explorations will continue next month.


Carbon Fiber Material

NORTHROP GRUMMAN

Working to Enhance STEM at Every Level

Ben Ingham
Northrop Grumman Corporation

STEM is vital to our nation

Our nation's security and economic prosperity depend on a highly educated work force with advanced skills in STEM. The shortage of STEM professionals in our country is a major contributor to our sagging innovation and competitiveness.

Northrop Grumman is a company that is long-known for its innovation and ability to apply technology and unique solutions to solve some our nation's most complex challenges in areas such as unmanned systems; cybersecurity; command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR); and logistics and modernization.

We are currently engaged in a multitude of programs to foster and improve education at all levels, particularly those that will further STEM education and encourage more young students to enter the field.

Northrop Grumman and the Northrop Grumman Foundation

The Northrop Grumman Foundation, a charitable giving arm of Northrop Grumman Corporation, provides support for education opportunities to our nation's youth and educators. In addition to the company, the Foundation is committed to supporting diverse and sustainable programs that create innovative education opportunities. The priority is to provide assistance to national-level STEM programs that span pre-school and elementary school through collegiate levels and put an emphasis on reaching diverse populations.

Employees at the company's many locations are engaged in their communities. Employees actively volunteer in support of several STEM organizations, causes, and programs for local youth. We also donate to local schools to provide them with high-quality STEM materials and resources. Half of the company's charitable giving is directed toward STEM education.

Our STEM activities

Northrop Grumman is involved with many organizations that promote STEM programs in schools and our communities to inspire the work force of tomorrow.

The Northrop Grumman Corporate Citizenship organization is responsible for developing and supporting K-12 education programming that excites students through informal education programs, engages students in STEM technologies and careers, offers professional development opportunities to teachers, and enhances the overall education experiences for students and teachers.

These programs are aligned with company goals for talent and technology development.

Professional Development for STEM teachers

"The Northrop Grumman Foundation has been pioneering programs to inspire science teachers for many years. We have turned our focus to the environmental sciences in recognition of the importance of international environmental sustainability to the health and security of future generations . . ."

Sandra Evers-Manly
President, Northrop Grumman Foundation

Virginia Initiative for Science Teaching and Achievement (VISTA): Recently, Northrop Grumman donated $1 million to George Mason University to support the VISTA program. The five-year program focuses on high-need schools to improve science teaching and student learning throughout Virginia.

VISTA is dedicated to professional development and research in science for elementary teachers and secondary teachers; science coordinators; and university science education faculty.

The VISTA program is a statewide partnership across more than 60 Virginia school districts involving Virginia Tech, the College of William and Mary, Virginia Commonwealth University, the University of Virginia, and James Madison University; and the Virginia Department of Education. The goal of VISTA is to translate research-based best teaching practices, and then apply their findings to improve the delivery of instruction and effectiveness of science education. Additionally, a community of practice is being developed among science educators throughout Virginia.

ECO Classroom: We have seized upon the national interest in environmental science by collaborating with Conversational International to launch the ECO Classroom program. Teachers are taught by Conservation International at its Tropical Ecology Assessment and Monitoring (TEAM) Network's field site at La Selva Biological Station in Costa Rica for an intensive, two-week experience. After leaving the program, the teachers are equipped to inspire students in their communities through the knowledge they gained while abroad. The Northrop Grumman Foundation is planning additional teacher trips for 2013 and 2014.

Sally Ride Science: Partnered with the Northrop Grumman Foundation, Sally Ride Science is a program aimed at equipping classrooms with high-quality resources to aid in the enrichment of students' STEM learning. Educator institutes and science academies offer professional development opportunities, leaving educators with a wealth of knowledge inspired by Sally Ride.

Students

CyberPatriot: After announcing a new partnership with the Air Force Association (AFA) for CyberPatriot III in 2010, we continued to fund this program in 2011 and 2012 through the Northrop Grumman Foundation. CyberPatriot is a national high school cybersecurity defense competition designed to excite, educate and motivate the next generation of cyber-defenders. A final competition was held at the Air Force Association CyberFutures Conference, April 1, 2011, in Washington, D.C.

This program is popular and growing – the number of teams jumped from 178 in CyberPatriot II, to 661 in CyberPatriot III. Enrollment for CyberPatriot IV came in at 1014 teams, a 53 percent growth.

Starting soon, AFA will develop a middle school component and bring in summer interns who have participated in the CyberPatriot program.

Space Camp: The mission of Space Camp is to be the premier provider of authentic, inspiring and entertaining educational experiences in space science and aviation. We send 48 students and 16 teachers from Northrop Grumman communities across the United States to the program in Huntsville, Alabama. We have funded the program for three years, covering travel, tuition, room and board, firsthand astronaut training for the "space travelers," rocket launching materials, and learning aviation principles. Our involvement in Space Camp reflects our interest in introducing middle-school students to STEM education in a unique setting.

VEX Robotics: An international robotics competition where kids at the middle school and high school level, as well as collegiate competitors, build robots to complete a specific task. The participants get a dose of what the "real world" is like by using project management and time management. Northrop Grumman contributes financially to the program and provides employee volunteers who serve as role models.

and supply guidance. As a result of our involvement, 76 new teams started at 58 new schools serving an estimated 760 students.

University of Maryland Advanced Cybersecurity Experience for Students (ACES): Northrop Grumman Foundation has partnered with the University of Maryland (UMD), College Park, to offer a landmark honors program designed to educate a new generation of advanced cybersecurity professionals. ACES engages a highly talented, diverse group of students—majors in computer science, engineering, business, public policy and the social sciences—in an intensive living-learning environment that focuses on the multifaceted aspects of cybersecurity and develops team-building skills. Students take on an advanced, cross-disciplinary curriculum developed through industry consultation, and interact directly with industry and government cybersecurity mentors. ACES produces skilled, experienced cybersecurity leaders highly sought by corporate and government organizations.

Cyber Scholars at the University of Maryland Baltimore County (UMBC): The Northrop Grumman Foundation provided a $1 million grant to launch the program which aims to develop cyber pros from historically underrepresented demographic groups and women.

"Northrop Grumman is proud to support education programs that will develop tomorrow's cyber leaders," said Wes Bush, chairman, chief executive officer and president of Northrop Grumman. *"Innovative partnerships like the Cyber Scholars program will further our nation's strategic objective to build a broad pipeline of qualified cyber professionals. I am very pleased the Foundation is partnering with UMBC on this important initiative."*

The program creates a learning community which will bring in 15 to 20 new scholars annually, further increasing the cybersecurity talent pool.

Diversity

Northrop Grumman also supports increasing diversity within the STEM fields. We are partnered with the National Association of Multicultural Engineering Program Advocates, Inc., National Action Council For Minorities In Engineering (NACME), National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Society of Women Engineers, American Indian Science and Engineering Society, Black Engineer of The Year Awards, Asian-American Engineers of The Year, Women of Color in Technology, Out & Equal, Jackie Robinson Foundation, Great Minds in STEM and other organizations.

Our membership assists these organizations in expanding the engineering and business pipelines through pre-college outreach, assisting undergraduate and graduate students to excel academically, and helping to cultivate future leaders.

Viva Technology and Great Minds in STEM: As a step in continuing efforts to introduce middle school students to STEM careers, employees at Northrop Grumman partnered with the company's Hispanic employee resource group, One Adelante, to bring the nationally acclaimed Viva Technology Program to Rogers Middle School in Lawndale, California, and Parkland Magnet Middle School in Rockville, Maryland.

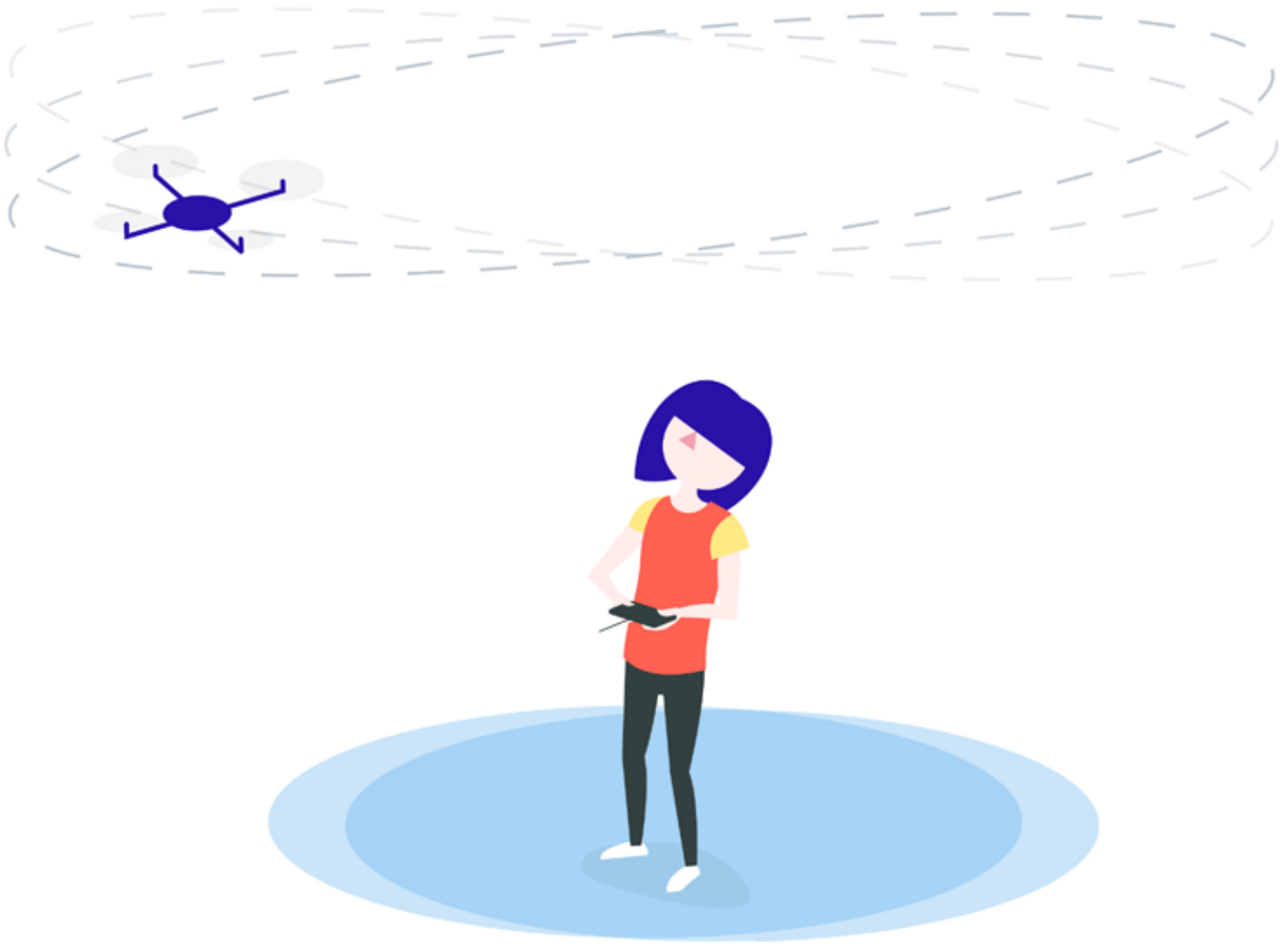
Workforce: Aerospace and Defense

Aviation Week and Space Technology conducts annual surveys on aerospace and defense workforce trends. In data from their 2012 Workforce Study, "national defense," appears as the first choice of young professionals who are looking for a STEM career. The survey also shows how much STEM enrichment programs, which offer team experiences, design projects, and project management activities are useful in preparing for careers in aerospace and defense. The university student survey showed a heightened level of interest in aerospace and defense: 71.8% in 2012, up from 62% in 2011.

The **majority** of students believe that *"personal relationships and interaction are the best guides to future employment."*

You care about your students. We're here to care about you.

KIDDOM.CO/STEM



Welcome to our newest readers at the University of Cyprus.

The University of Cyprus is located in Nicosia (Lefkosia), the island's capital city. Nicosia is the administrative, commercial, cultural, educational and religious centre of the country, and is also geographically at the centre of the island. A modern highway system connects Nicosia to all main towns and cities, many in under an hours' driving time.

Cyprus enjoys a Mediterranean climate, with abundant sunshine all year round. Long, dry summers and mild winters are separated by short autumn and spring seasons.

The University of Cyprus is a public coeducational university established by the Republic of Cyprus in 1989. It admitted its first students in 1992 and has approximately 7000 students.

7 Things Higher Education Innovators Want You to Know

In order to close the growing achievement gap, higher education institutions need to focus on innovation, scale and diffusion, according to Bridget Burns, executive director for the University Innovation Alliance, a coalition of 11 public research universities committed to improving graduation rates and sharing best practices. And most important, institutions need to communicate about what works and what doesn't. *"Otherwise we are sentencing other universities to repeat our mistakes and our failures — and students deserve better,"* she exhorted.

1) Learning is becoming measurable — and more flexible. *"We are right on the cusp of being able to measure student learning for the first time,"* said Ted Mitchell, under secretary of education for the U.S. Department of Education. *"And this isn't just about new tests — this is about new environments for learning"* that help teachers and mentors better understand what makes students successful.

Mitchell gave the example of flight simulators, which not only provide students with a way to engage in the activity that they want to learn, but also have data systems that monitor students' learning over time, providing them with structured feedback at just the right moment. This sort of data-centric assessment of learning is happening in more and more disciplines — and that opens the door to more innovation, he argued.

"As we approach the measurement of student learning through competencies and masteries, it unlocks a lot of innovative practice," Mitchell noted. *"Once one has identified the skills that students need to master, and accomplished the task of being able to measure those, you can make the learning exercise itself far more flexible."*

For instance, competency-based education now makes it possible to learn from anywhere, anytime — which is particularly important for today's non-traditional students balancing education, work and family.

2) We need a common definition of college affordability. *"Politicians, policy-makers, higher education administrators — everyone wants to make college more affordable. But what does that really mean? How do we gauge whether or not college is affordable?"* asked Zakiya Smith, strategy director for the Lumina Foundation. There are a lot of different ways to measure the cost of college — sticker price, net price, return on investment, student loan debt — but none of those things really mean anything if we can't come to a common understanding of what college affordability means, she said.

To address that gap, the foundation introduced the **"Rule of 10"**: Students should be able to pay for higher education with savings generated from 10 percent of their discretionary income, over 10 years, and working no more than 10 hours a week while attending college. In this model, college affordability is defined based on a student's individual circumstances, acknowledging that the cost of college should be an investment over time.

"This is still under development," said Smith. *"We're hoping to get more feedback on this over the next year or so, and we really want to engage in a conversation with the community about whether it seems like this makes sense."*

3) The waves of change in higher education are far from over. *"Our society is evolving much more rapidly than any institution of higher education,"* Crow said, pointing out that the current production of college degrees in the U.S. is woefully behind population growth.

To achieve its goals in graduation rates, higher education needs a new wave of innovation, he said, citing his own university's efforts to create a new model of education where *"full immersion and digital immersion are possible, costs are constrained and the scale is all scales, from individual learner to massive groups of learners, all operating at the same time."*

We must embrace immersive, technology-enhanced learning (both on-campus and online), massive-scale learning, and the concept of education through exploration.

"Now there are no more teachers, no more professors at the front of the stage — they are engaged in the creation of learning environments that allow people to learn at scales and in ways that have previously been not possible."

4) Traditional instruction may no longer work for today's diverse learners. *"One of the great things about higher education is that we're not only getting a greater number of learners, but also a greater diversity of learners — diversity in terms of age, sex, gender identity, culture, ethnicity, work status, and on and on and on,"* said Candace Thille, assistant professor at the Stanford Graduate School of Education.

"We need innovation," she said, adding, *"I believe very strongly that innovation will come from inside not-for-profit higher education,"* rather than from external sources or markets.

"The challenge is that it's all still active research," noted Thille. And there's a problem: Many of the predictive models are proprietary, with vendors unwilling to share the inner workings of the technology. We need the models and the data to be open, transparent, peer-reviewable and subject to academic scrutiny. Models reflect the values of the people who designed them as well as the behaviors of the population from whom the data were collected.

When models are built on our existing norms, *"we risk tooling the norms into the technology and then reproducing inequality,"* she warned.

5) It's time to take data seriously. Ten years ago, Georgia State University faced serious achievement gaps, with graduation rates hovering around 30 percent. But thanks to a campus wide commitment to student success and a focus on data, said Timothy Renick, vice president for enrollment and student services, the institution has made a dramatic turnaround, raising its overall graduation rate by 22 points.

"We began to actually examine what we could do differently — based upon what the data told us the problems were for the students we enroll," said Renick. *"We made a commitment not to raise our graduation rate through getting better students, but through getting better — and that gain meant looking in the mirror and making some significant changes."*

"When we looked at the data, one problem we found was that even the students who graduated from Georgia State were going through two-and-a-half majors before they graduated," he explained. *"Low-income students can't afford to go through two-and-a-half majors before reaching the finish line. They rack up wasted credit hours, they add time to their degree."*

With 90 majors available to them and no context to help in the selection process, students struggled to find the right fit.

The university has now introduced "meta majors": broad categories like STEM, business or education that allow students to explore a field before committing to something more specific. During their freshman year, students take classes around those topic areas, attend lecture series, meet with faculty and go through diagnostics to help narrow down their interests. "By the time they pick their first major, it's going to be the thing that sticks," said Renick, adding, *"In a two-year period, we've lowered the number of major changes at Georgia State by 30 percent."*

Paying attention to data led to a host of other changes at Georgia State, including the implementation of adaptive learning for introductory math courses, "micro-grants" that help students with end-of-semester financial shortfalls, and predictive analytics for student advising.

"What is the collective impact of this approach to taking data seriously? We're graduating 1,700 more students every year," said Renick. *"In fact, we moved our graduation ceremonies from campus to the Georgia Dome, where the Falcons play, because we ran out of room."*

6) A 21st-century learning culture starts with digital content. In 2010, Jackson State University was looking for ways that technology could better address the needs of today's learner. *"We put together what we call our cyber-learning ecosystem,"* said Robert Blaine, dean of undergraduate studies and cyber-learning. *"What that means is that we're building a 21st-century learning culture for all of our students."*

At the core of that ecosystem is digital content, delivered via university-supplied iPads. "We produced digital textbooks for students and we were able to do some amazing things right off the bat," said Blaine. "First of all, we lowered the cost for students by over 90 percent. The traditional textbooks that they were using would cost between $100 and $300 a book. These books cost $9.99."

The benefits of digital textbooks go beyond cost savings, noted Blaine. Jackson State is able to align its learning content with the specific outcomes that the institution wants to achieve. "We're able to coordinate the curriculum and focus on the skills that students need," he said. "And we're able to bring new relevance to the curriculum by bringing voices into the conversation that have been historically left out."

That is the philosophy behind Project 2021, a UT-Austin initiative focused on reinventing undergraduate education. The project aims to *"change the nature of teaching, the nature of how we do curriculum, and rethink how we think of a course calendar,"* said Pennebaker. A key part of the revamp is finding ways to measure what works.

"One of the best predictors of dropping out of college is the failure to feel a sense of belonging."

7) We need to change the way students think. Developing the skills to think and work through problems is every bit as important as mastery of the material in a particular subject, according to James Pennebaker, a professor in the Department of Psychology at the University of Texas at Austin. When students learn to change their fundamental thinking, he said, they carry those skills over to other subjects.

"If individuals take a class and do well, they should do better in their next courses. If they take my class, I hope they do better in future classes, and I don't care if they have anything to do with psychology," he asserted.

"We're building a research infrastructure that will go through and analyze not just how [students] do in their classes and future classes," said Pennebaker, *"but also, how do they change in terms of their connection with others? Do they become more connected with the university?"*

The university is also working to engage students with a sense of community. *"As we develop various classes, including online classes, one of our biggest fears is that students become more disengaged, less connected with others,"* Pennebaker explained. *"One of the best predictors of dropping out of college is the failure to feel a sense of belonging."*


$E=mc^2$
If you knew what this meant, would you feel smarter?
If you knew what this meant, is there any math you couldn't learn?
(now you can brag to your parents)
* Simplified explanation of components designed for encouragement

Einstein's energy-mass equivalence equation

E stands for energy.

Energy is measured in joules (J), a unit for measuring energy like using inches or pounds to measure other things. How much energy is one joule? Not very much really. If you pick up a large apple and raise it above your head you will have used about one joule of energy. On the other hand, we use up huge amounts of energy every time we switch on a light. A 100 watt light bulb uses 100 joules of energy every second.

Joule is named after the English physicist James Prescott Joule (1818–1889). If I wanted to know how much energy is in an object...any object like metal, plastic, wood, rock or even pizza, I would use this equation.

m stands for mass.

For our purposes we can think of mass as the amount of matter (stuff) in an object like a rock or ball or even you! Mass is measured in kilograms instead of pounds **so everyone in the world is using the same measuring tool**. One kilogram is about 2.2 pounds.

For our older readers, Mass is a measure of a body's resistance to acceleration. The greater the mass the greater the resistance to acceleration, as anyone who has ever tried to push a heavy object knows. So for everyone, the harder it is to push the object, the greater the mass and the greater the energy it would turn into.

C stands for the speed of light in a vacuum, like space. It probably comes from a Latin word *celeritas* that means speed. As far as we know, the speed of light never changes, so it's always the same or a "constant". *(we could be wrong)*

The speed of light is very close to 186,300 miles per second (300,000 kilometers per second). That's really fast. In order to make the equation "work" we need to convert these numbers into metric units **so everyone will use the same way of measuring**. In physics speeds are measured in metres per second or about 3 feet per second.

2 stands for "square", a math symbol of multiplication. Since it comes after the speed of light, it mean we have to multiply the speed of light times the speed of light. So that would be 300,000 X 300,000. You can do that on your calculator.

Understanding is a step by step process. **You ARE smart!** This is only the beginning.....

MOMENTUM

Dr. Reginald Windom

Psychological momentum is a powerful force in school, life, sports, and business. Recently many of us were glued to our screens watching psychological momentum play out on the courts of the NCAA Basketball Tournaments.

For reasons unknown, the selection process of the NCAA Tournament pits often unexpected competitors against one another, regardless of past performance, resulting in unknown teams sometimes upsetting larger, more talented rivals through sheer will to win.

As school continues to challenge your short and long term goals, attitude from day to day, self esteem, abilities, mood and behavior it's important to be reminded that all of these influences are actually controllable.

As we watched with bated breath the NCAA Tournament brackets, the display of psychological momentum and fortitude we witnessed during March Madness can be a powerful lesson for school, business and life.

momentum;
noun
mo·men·tum \mō-men-tm,

- the strength or force that allows something to continue or to grow stronger or faster as time passes/

1 Understand that it's all in your head. Psychological momentum is defined as a state of mind in which an individual or team feels things are going unstoppably their way. It's a concept well known in the world of sports.

According to the American Psychological Association's Review of General Psychology, 93% of basketball coaches believe their performance is "crucially determined by momentum." The impact is so strong, studies have shown that coaches frequently change their overall behavior and adopt a more aggressive strategy after a single successful play early in the game.

When it comes to school, a similar psychology plays out. Observers are often amazed at a students ability to excel in a subject after a short series or even single successful grade result, boosting confidence, attitude and hope.

This momentum isn't necessarily due to specific successes, but rather how we perceive the actions we take afterward. It maybe a simple C+ rather than that regular D that builds a sense of momentum that keeps us moving forward.

2 Your emotions don't control your behavior; rather, your behavior controls your emotions.

It's a head game. This idea is ingrained in anyone who has played team sports. Why do sports teams often dress formally before a game? They do it because the sense of professionalism and discipline that goes along with dressing up actually influences behavior on court or playing field. This attitude is not only important and powerful, but should begin in grade school.

Do private schools wear uniforms just to remove individually in the classroom or does it go further, establishing a level of professional appearance that may influence scholastic performance. Is it a coincidence that graduation rates and testing results are repeatedly higher in private schools nationwide compared to public schools?

Once you adopt the "as-if" principle, your internal psychology shifts. Challenges and obstacles begin to be viewed as opportunities, rather than reasons for despair. We can celebrate successes, no matter how small, and eventually a feeling of positive momentum takes hold.

3 Build momentum in every class Naturally, coming to these realizations and, more importantly, putting them into action takes a lot of time and effort. What emerged from this introspective process are five key principles that can be applied to any subject.

-Act like you're already succeeding. Conduct yourself in a manner that exudes confidence. Come into class composed, well rested, and energized.

-Focus on the positive. Don't dwell on problems. Instead, look at them as opportunities for greatness. Be realistic, but try to frame things positively at all times.

-Celebrate victories. It doesn't matter how small they are. Make sure your teacher and parents know about wins and recognize their contributions every time.

-Show excitement. Show optimism in everything you do, regardless of the grade you get or class you're in.

-Don't give up. If you find yourself short on success and start to see pessimism on the rise, don't despair. It takes determination to build momentum. Just keep pushing and you'll get there.

Remember.....it's all in your head.

"Keep pressing..."

STEM Magazine is.....Global