

# STEM.

M A G A Z I N E

The **CORPS**  
*Engineering the future*

**SOFIA** continues to fly  
Stratospheric Observatory For Infrared Astronomy

The “*Art*” of **STEM** (STEAM)  
*Wayne Carley*

Academic Si|os  
*Dr. Richard Larson, MIT*

December 2014  
**//150v**

Dear Educators,

The holiday season is fully upon us! While we realize that each of you is inundated with responsibilities both inside and outside the classroom, we ask that you help us maintain the quality and professionalism of the MSP grant by scheduling your evaluations and saving the dates for the STEM Innovations professional development sessions on February 5, 2015 and March 19, 2015. Please contact Dr. Sorge at [bsorge@iupui.edu](mailto:bsorge@iupui.edu) or at 317-274-7029 to schedule evaluations or to let him know you are interested in participating in classroom observations-an important element of the evaluation process.

This month marks the first of the professional development sessions for the teachers who attended the STEM Innovation summer institute. We are excited to lead important work that will utilize engineering ideas to support STEM learning, assessment strategies, and teaching the MiB challenges developed during the summer session. Below is a brief description of what the first session will include.

When working on using engineering ideas teachers will:

- Participate in an engineering based activity
- Review the STEM Integration Curriculum Assessment
- Discuss ideas to incorporate engineering principles like process of design

During assessment strategies teachers will:

- Learn how to align assessments with learning objectives and STEM content
- Use examples that allow students to demonstrate their understandings in different ways

When working on and reviewing the MiB lessons teachers will:

- Share experiences teaching the MiB lessons
- Discuss challenges with the lessons and strategies for addressing the challenges
- Work with partners from the summer to prepare to teach the lessons or debrief lesson outcomes

**STEM-FOCUSED HOLIDAY LINKS:** This time of year is very busy so we have compiled a few links to STEM-focused resources, activities and lesson plans to help celebrate the holidays in your classroom-whether it be Christmas, Hanukkah or Kwanzaa. Enjoy!



Your STEM Innovations Team

Are you sharing this magazine with your students?

If so, **please** let me know at:

[wayne@stemmagazine.com](mailto:wayne@stemmagazine.com)



Please use it in class.  
It's PDF printable too!

## Army Corps: Life Lessons

dr. joanne *Castagna*

## Academic Silos

dr. richard *Larson*, MIT

## **SOFIA** *Flies Again*

Stratospheric Observatory For Infrared Astronomy

dana *Backman*

coral *Clark*

pamela *Harman*

The "*Art*" of STEM

wayne *Carley*

**5** Minute STE(a)M Lesson

For every grade and every subject

## Classroom in The Cloud

dr. gene *Levinson*

## Subscriptions

S.T.E.M. Magazine is provided to individual schools, districts, counties and countries with a customized edition for every application.

S.T.E.M. Magazine Inc.  
[www.stemmagazine.com](http://www.stemmagazine.com)

S.T.E.M. Magazine Inc. 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.

S.T.E.M. Magazine believes that the key to success in seeing higher graduation rates, improved testing results, student inspiration and a strong work-force rests 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 and inspiration, the foundation of every career passion.

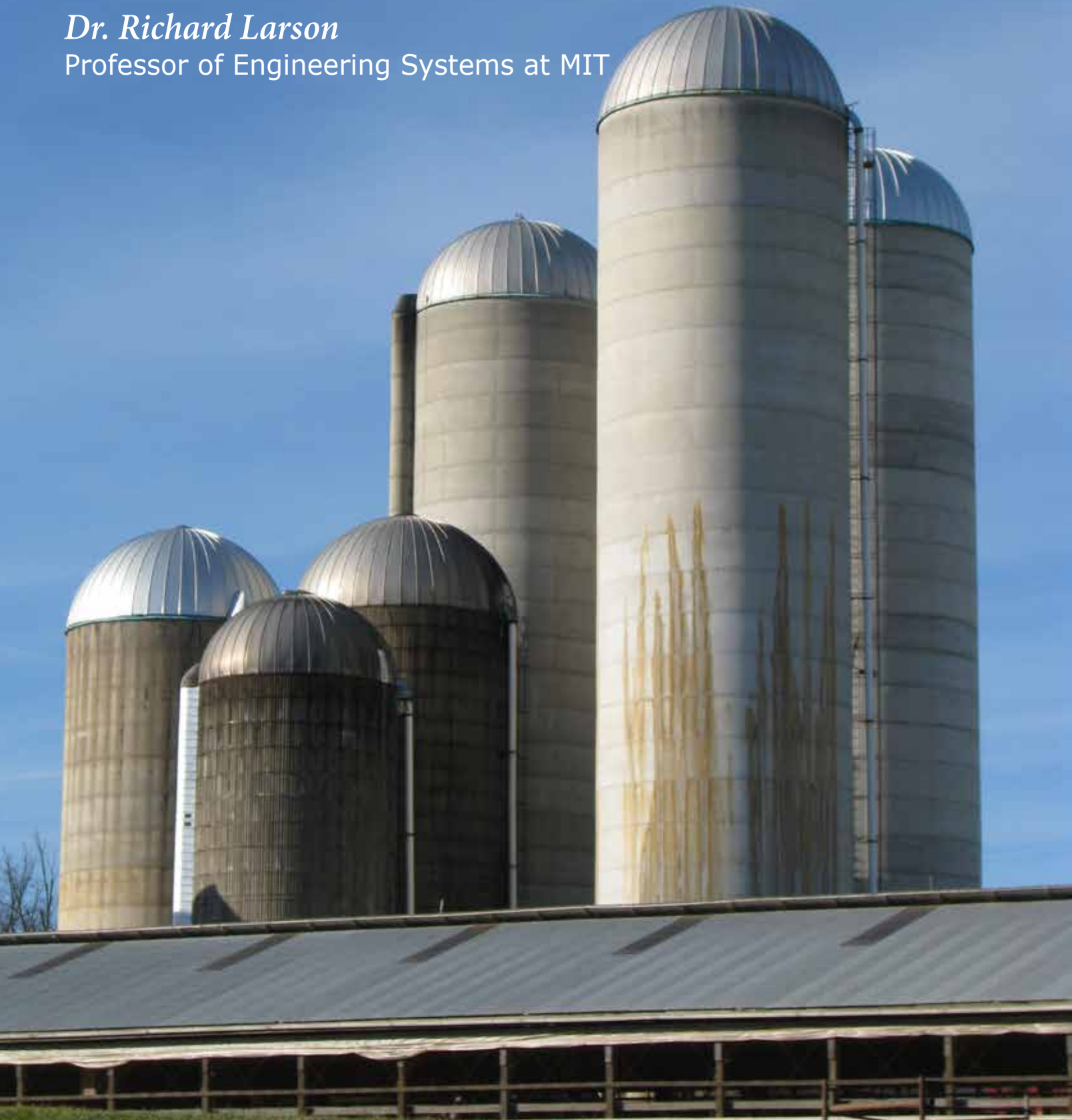
*Wayne Carley*  
Publisher

[wayne@stemmagazine.com](mailto:wayne@stemmagazine.com)

# *Academic* Silos

*Dr. Richard Larson*

Professor of Engineering Systems at MIT



Think of our usual academic silos: math, biology, physics, chemistry, robotics, computer programming. And these are only the STEM silos.

Experts in these subjects probably wrote the textbook for each course, and to be an expert, one needs to have spent lots of time in his/her own silo! Then at the secondary school level, we have teachers silo'ed—as teachers of algebra, biology, chemistry, etc. Silo'ed educational 'materials' are neatly arranged, scaffolded and presented — some of it centuries old. And tests, including high-stakes standardized tests, focus on silo'ed content.

Students slave to understand and repeat back what they have learned, but often without much motivation. Their learning occurs in **silos**.

As we all know, the real world does not operate in silos. Professor Megan Rokop has an inspiring

article on Ebola. Approached from a biology perspective, she describes the human element in undertaking urgent research, where researchers place their lives at risk to learn how to save the lives of others.

In contrast to a staid textbook approach to biology, this story shows that research is alive and well, constantly pushing boundaries and conducted by brave living human beings. Lessons in ethics and social science arise from this case, perhaps even more than the biology research achievements.

***Here is my suggestion:*** Every once in a while in a STEM class, engage in an open-ended class conversation about an important topic currently in the news. Explore how the silo'ed topic of that class meshes with broader societal concerns.

Discuss the need to bring into the analysis other silos, especially ones that are not STEM related. STEM may be a necessary ingredient in

the discussion, but it is not sufficient to cover all relevant factors, to come up with a reasoned and balanced strategy to frame and tackle the problem.

About five years ago I started doing this in an MIT class with pandemic influenza, motivated by the then-new virus called H1N1. The class (MIT ESD.86: “Models, Data and Inference for Socio-Technical Systems”) is primarily mathematical, covering applied probability, statistics and decision analysis.

But we found in our class discussions and in on-going CDC-funded flu research, that the equations in the “flu math” were driven by human behavior. “Social distancing,” improved “hygienic behavior,” and other ‘Non- Pharmaceutical Interventions’ (NPI’s) were human control mechanisms that provided individuals, families and friends with the ability to reduce significantly their chances of getting the flu.

The math of infection propagation was in their hands, almost literally

(frequent soap-and-hot-water hand washing!) As a result of these discussions and the students’ interests, we were able to bring in aspects of social science (for human behavior) and even management (for the health care system’s response to the flu).



In that way the students learned the need to add and incorporate non-STEM thinking in with their STEM analyses. It also provided them with a huge motivation to



learn the math, as they now saw its relevance and importance in addressing a significant societal problem.

Reaching outside the classroom, beyond the textbook, to today's important issues—showing how



math, science and engineering relate to today's problems—that is one major way to motivate students and broaden their thinking at the same time. Today that

important topic in the life sciences is Ebola. Hopefully this humanitarian crisis will be wrestled to the ground within the near future, with innovative STEM thinking integrated with appropriate social science and management.

Five years from now, undoubtedly there will be another crisis to bring to the class. And the students will benefit from these discussions.

Think outside the silo



The “*Art*” of S.T.E.M

Wayne Carley



Without doubt, the arts and artistic design are intricately woven into science, technology, engineering and math, career fields we *desperately* need.

I'm right brained anyway and spent over 20 years as a professional photographer and musician..... certainly an artist at heart, and now as a publisher I find artistic reward in designing STEM magazine to be visually appealing and engaging. Don't think for a minute I don't support or understand the necessity of "arts" awareness within the STEM disciplines.

Inspiration, creativity, imagination ....are the beginning of most STEM innovations. As far as including another acronym and embracing "STEAM", I'm not sure that is necessary as much as the "arts" professionals would like their own acronym.

Research shows there is not a shortage of artists in the world and artisans play a very small role in our local, national and global economies, but having said that, we cannot afford to ignore the "Arts"

**Every company should have an Arts major on staff!** When they do, they usually reside in the marketing and design departments or even human resources.

and those who excel in that discipline in direct support of STEM careers and global competition.

*If there IS a shortage*, it's in understanding how inter-woven and elemental inspiration, imagination and creativity are in STEM. STEM Magazine will continue to include articles about language arts, design, imagination and dreaming as necessary components to completely understand and excel in STEM education.

## SCIENCE

Though math is the language of science, the artistic design of nature and the universe cannot be denied. The complexity of the world and universe may be explained by equation and theory, but the source of its aesthetic beauty eludes me even while I revel in it.

Without imagination and creativity, breakthroughs in genomic study, medical applications, prosthetics, transplants, technology synergy and more would never be realized. When we imagine what might be, STEM allows us to make it real.

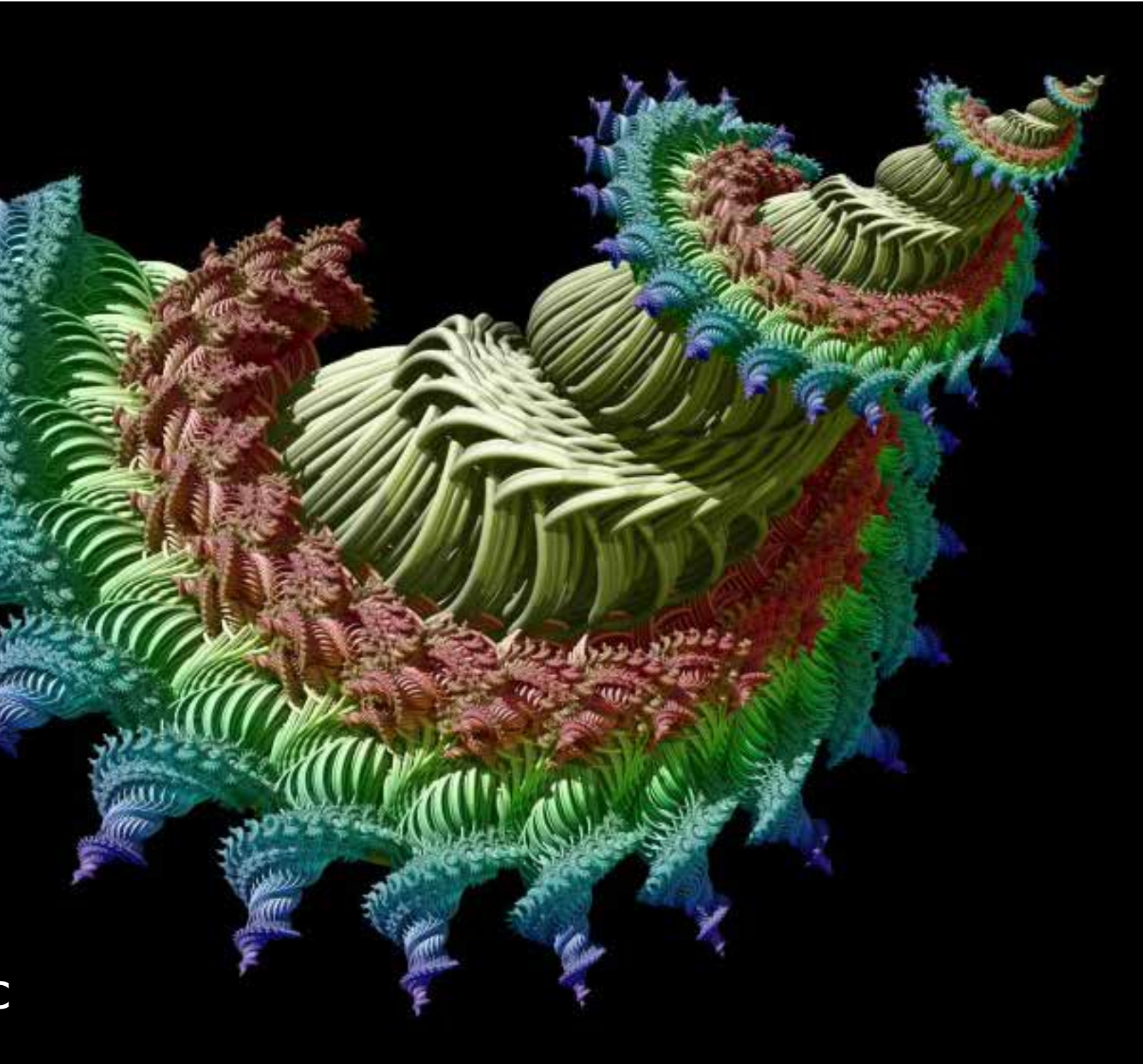
**Art defined, in general:** a branch of as music, philosophy, or literature.

Art is mathematical

Art is scientific



learning or university study, especially one of the fine arts or the humanities,



Technology is Artistic

*Music* is very **MATHEMATICAL**



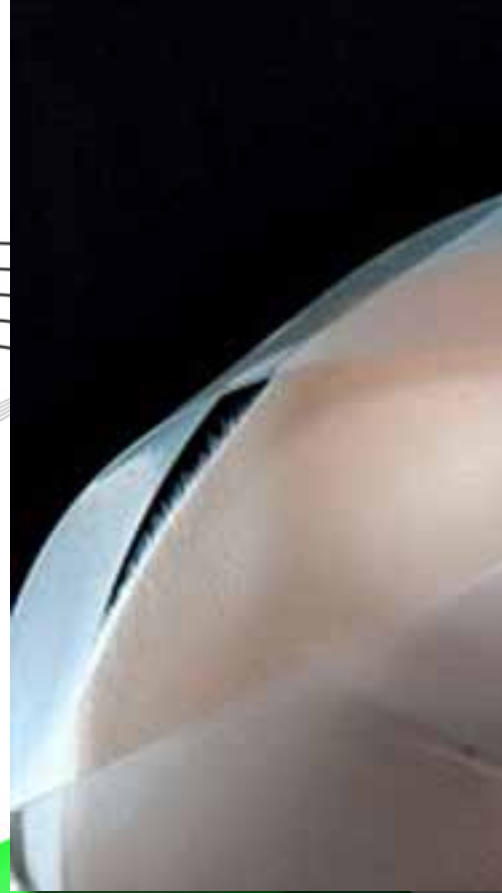
The *humanities* determine our STEM ethics and motivations.

*Philosophy* is the rational investigation of the truths and principles of being, knowledge, or conduct. “*Just because we can make a thing does not mean we should.*”

### **CREATIVITY**

is the ability to transcend traditional ideas, rules, patterns, relationships, or the like, and to create meaningful new ideas, forms, methods, interpretations, etc.; originality, progressiveness, or imagination:

This may be the **heart** of STEM. Without creativity, how will we break traditional thought, break breakable rules, embrace NEW methods, progress, find new meaning, apply new applications?



**Inspiration:** stimulation / ar





I was *inspired* to **experiment.**

I was *inspired* to **innovate.**

I was *inspired* to **solve a problem.**

I was *inspired* to **theorize.**

I was *inspired* to **calculate.**

I was *inspired* to **design.**

I was *inspired* to **question.**

ousal of the mind, feelings..to special / unusual activity or creativity

I was *inspired* to **seek.**

I was *inspired* to **explore.**

I was *inspired* to **build.**

I was *inspired* to **teach.**

I was *inspired* to **pursue STEM.**

We're not done talking about this...





# 5 minute STE(A)M lesson..

..for *every subject* and *every grade*.

**Architecture:** (architect) the profession of designing buildings, open areas, communities, clothing, technology and other artificial constructions and environments, usually with some regard to aesthetic effect.

Architecture often includes design or selection of furnishings and decorations, supervision of construction work, and the examination, restoration, or remodeling of existing buildings or material objects.

## Assignment:

*Name as many ways as you can that an architect uses science, technology, engineering, math and art to create a project.*

WHAT IS THIS?



# Army Corps

share life lessons with elementary school students

By *Dr. JoAnne Castagna, Ed.D.*



**Lt. Col. John A. Knight**, deputy commander, U.S. Army Corps of Engineers, New York District giving students his autograph. *Credit: JoAnne Castagna, Public Affairs.*

“Can I have your autograph?” a third grade student asked Lt. Col. John A. Knight, deputy commander, U.S. Army Corps of Engineers, New York District. Knight took the piece of paper the student handed to him and signed it. “Can I also?” shouted another student. Knight smiled and chuckled as the class of third graders began to quickly huddle closely around him. All asking for autographs.

The students are from Brownsville Elementary School in Brooklyn, New York (P.S. 150). Recently, Knight and other Army Corps presenters spoke with the school’s third, fourth and fifth graders as part of the District’s STEM Program (Science, Technology, Engineering and Math).

*“The goal of the STEM Program is to inspire young girls and boys to pursue careers in science, technology, engineering and mathematics,”*

said Jean Lau, equal employment opportunity office (EEO) specialist

and STEM outreach coordinator with the U.S. Army Corps of Engineers, New York District.

The District did the STEM program as part of the school’s “Dad’s Bring Your Child to School Day and Career Day.” Knight and the rest of the presenters were treated like rock stars and asked a lot of questions and this is exactly the result they wanted from these students that live in an impoverished area of New York City and lack positive role models.

The presenters took this opportunity to share some life lessons.

**“You have to make the right decisions”**

Knight walked into the class rooms wearing his fatigues and the students were impressed.

A boy asked him what his favorite combat weapon was. Knight pointed to his head and said “This.” He continued, “I get asked this question a lot by students and I always

say that this (pointing to his head) is your best weapon for success. Study. You have to have a dream, a passion and work hard.”

Another student asked Knight what his biggest challenge was. Knight said that when he was in middle school that he almost made a decision that could have changed the path of life. He said that he was hanging around with a bad crowd.

He could have continued to stay with this crowd, but he decided not to. He said, “It wasn’t ‘cool’ but the right thing to do. If I had made a different decision, taken a different path in life, I may not be where I am today. You will also be faced with decisions like this. There will always be challenges.”



# You have unlimited possibilities



Seth Greenwald, technical manager, Engineering Division, U.S. Army Corps of Engineers, New York District talked with the students about careers in engineering.

Greenwald asked the students what they thought engineers created. The students shouted out - bridges,

buildings, spoons, furniture and computers. Greenwald said, “You are right. Engineering touches everything.”

Greenwald said, “After coming up with an idea, an engineer will create a sketch to illustrate the concept. If you want to be some

one who turns their ideas into reality by using the design process - you should consider becoming an engineer.”

As an example, he showed the students a simple line sketch that one of his colleagues did. He told the students that this was the initial concept for something that helped people during Hurricane Sandy!”

### **You can solve puzzles that will help society**

Gail Woolley, civil engineer, U.S. Army Corps of Engineers, New York District said, “Engineers are problem solvers. We take pieces of a puzzle and try to solve a problem.”

She gave an example of a project she is working on - The Jamaica Bay Marsh Island Project.

She asked the students if they knew that there are actual islands in Jamaica Bay and many of them didn’t know this. She said that over the years these islands have been disappearing fast and we aren’t

sure exactly why.

She told the students that she and her team brainstormed to see how this problem could be solved.



The team realized that they can use dredged sand from the District's New York/New Jersey Harbor Dredging Program to build these islands up again. The harbor is dredged to allow large container

ships into the harbor. Usually this dredged sand is placed in the ocean, but we used it to create these islands.

Woolley said proudly, "What is also wonderful is that after these islands get restored we are seeing



wildlife return to them. It makes me feel good that I designed an island - made a difference.”

She added, “Creating these islands involves math. I had to figure out how much sand was needed to build up the island. This required measuring and calculating.”

A student asked her if she dreamed of becoming an engineer when she was a kid. She responded by saying that when she was in 7th grade in girl scouts her troop had a field trip to City Hall. “We visited all of the departments including the Civil Engineering office.

I was fascinated by the designs displayed in the office. When the troop was leaving the office, the engineer who spoke with us was closing the office door. I asked him what type of engineer he was and he said a civil engineer. This is when I knew I wanted to be the same thing.”

**You should keep learning.**

Lau talked with students about what she did for the Army Corps and how she has grown in her job.

Lau was a Psychology major when she joined the Army Corp 13 years ago to be a counselor. Today she works for the agency’s Equal Employment Opportunity Office. She told the students that this office makes sure that “everyone at the agency is treated equally no matter if you black, white, male or female.”

A student asked her if she liked her job and where she saw herself in the future. Lau said that she loved it and that she always wants to keep learning. Never keep still.

Ian Pumo, civil engineer, U.S. Army Corps of Engineers, New York District talked with the students about how he decided to become an engineer.

He told the students that when he was in high school he was working with the school’s theater group.



He was responsible for designing and constructing the sets and coordinating volunteers and technicians. He didn't decide to major in engineering until his high school counselor told him that what he was doing was Civil Engineering.

Pumo felt it was important to relay this to the students to show them that many of us don't know what we want to do with our lives when we are young and that they should continue to do what they enjoy

and continue learning so that they can figure it out.

*Dr. JoAnne Castagna* is a Public Affairs Specialist and Writer for the U.S. Army Corps of Engineers, New York District. She can be reached at: [joanne.castagna@usace.army.mil](mailto:joanne.castagna@usace.army.mil).

Follow her on Twitter at <http://twitter.com/writer4usacenyc>



# ENGINEERING is problem solving.

You need to solve big problems, small problems, everyday problems ...there is a **METHOD** and you already use it several times a day.

*Let's refresh your memories.*

1. Identify problem
2. Suggest possible solutions
3. Test solutions
4. Evaluate results
5. Pick best solution
6. Done.
7. Next?

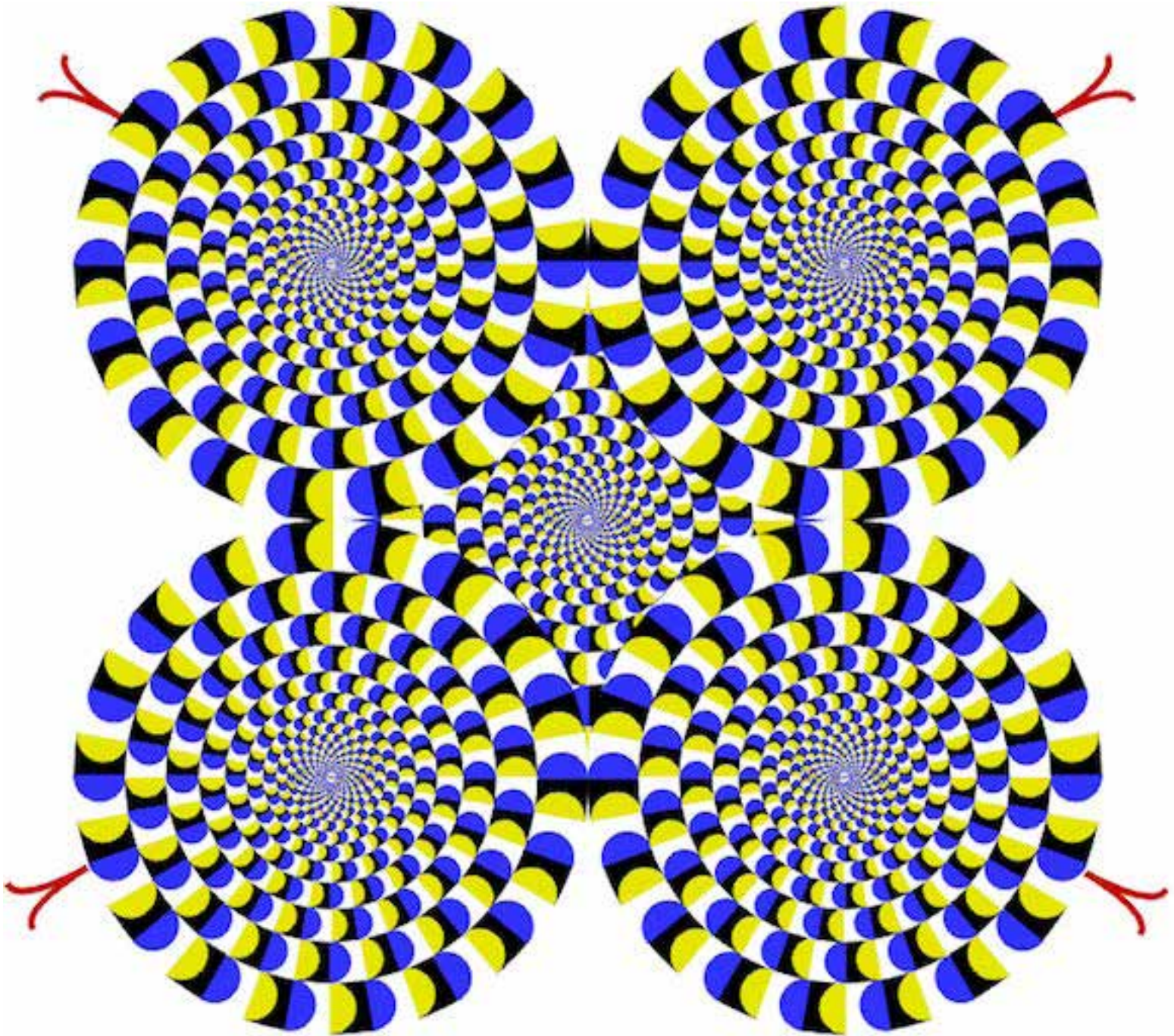
## Students:

- how do I get to basketball practice?
- how can I stretch my money?
- how can I finish all this homework?
- how do I make up with my best friend?
- how can I get my parents to see my side?
- how can I get a better grade in a class I don't like?

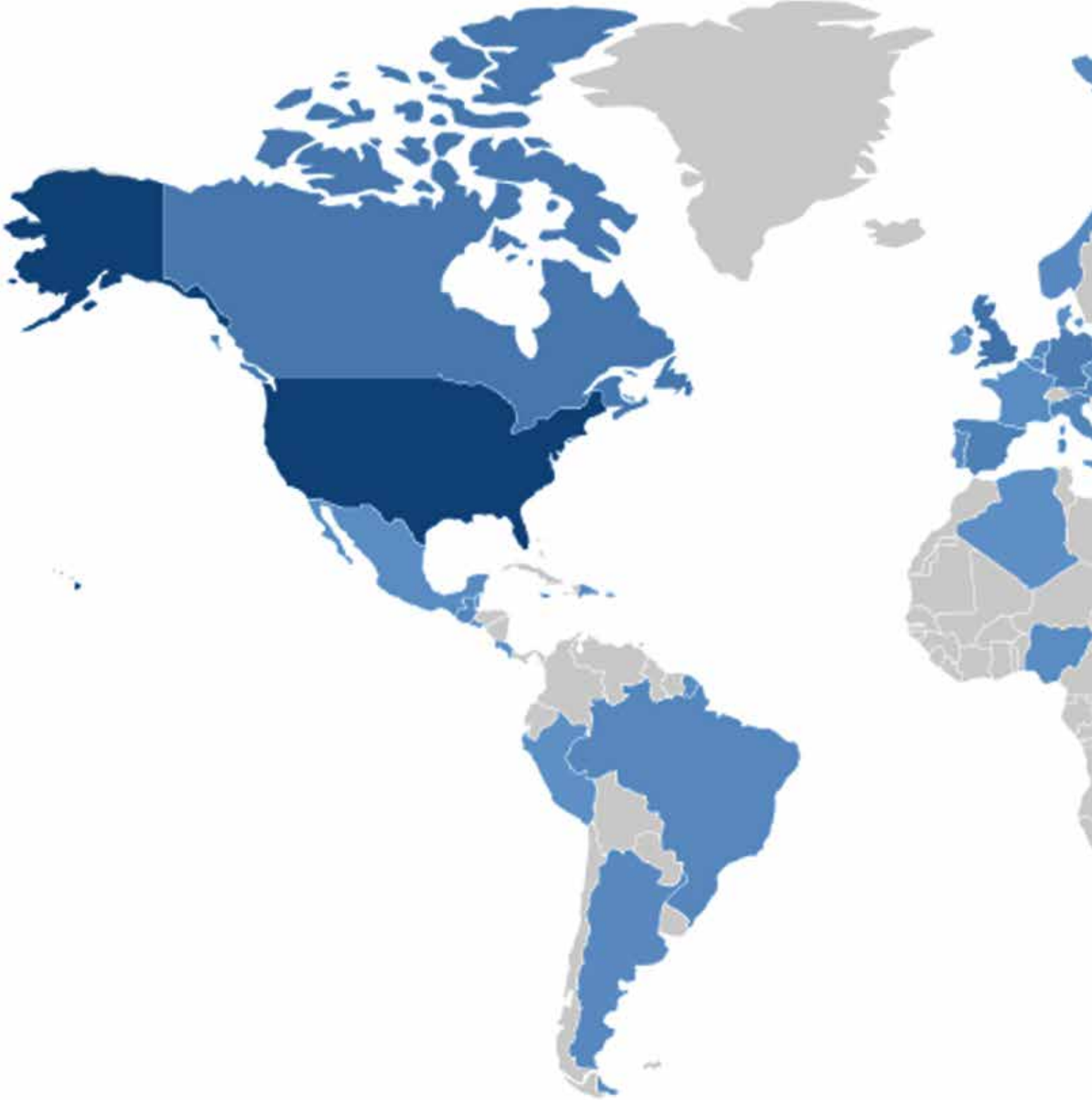
## Teachers:

- how can I inspire my students?
- how do I incorporate this into the lesson plan?
- how do I get the administration to support this new program?
- how can I keep my cool when the class is going wild?
- how can I find my passion to teach again?

Solve this one.....

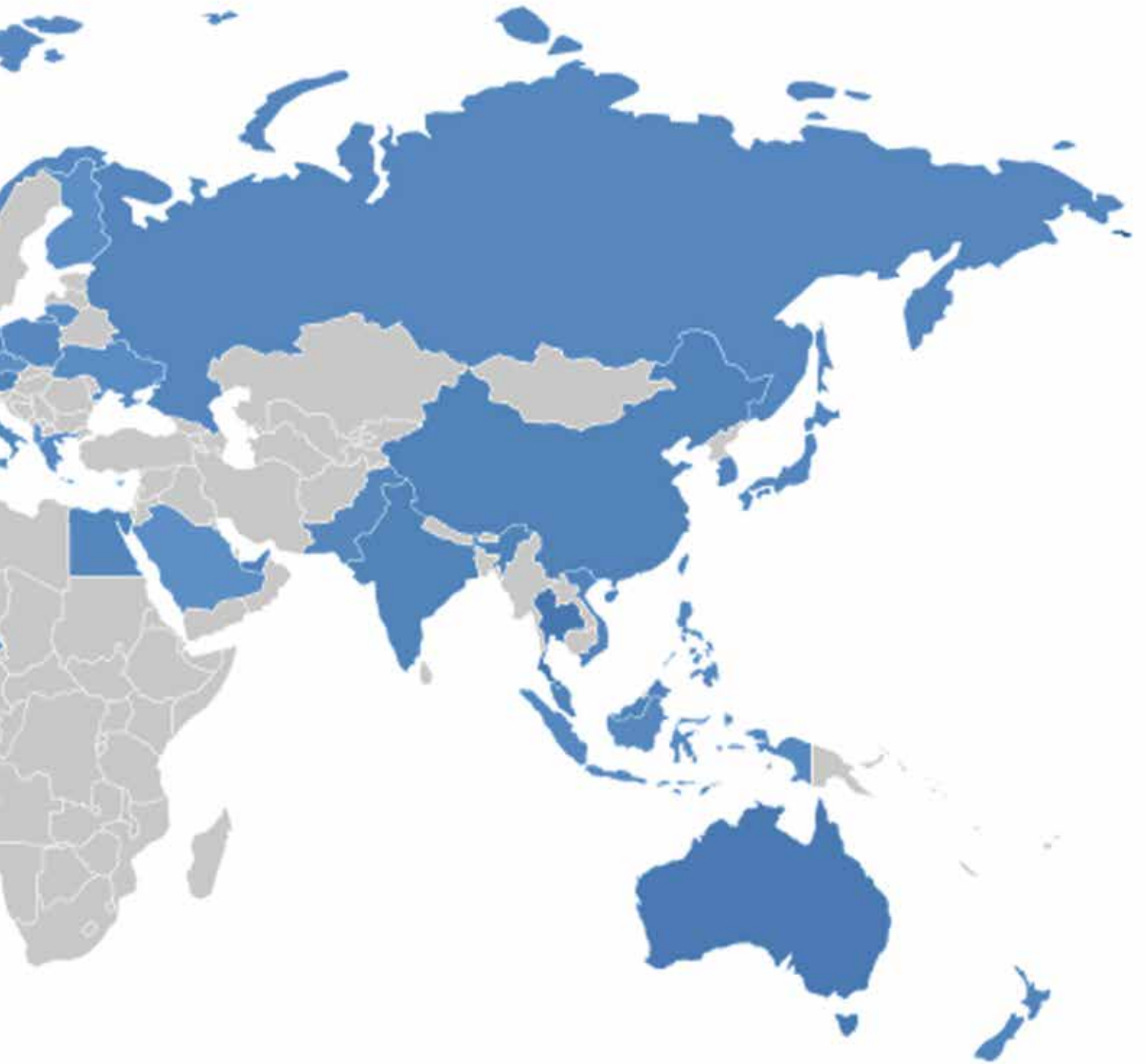


# Current global monthly readers of STEM Magazine



51% (+) of monthly readers

49% (-) of monthly readers



ISSUU





Continue Flying with

**SOFIA**

Stratospheric Observatory For Infrared Astronomy

# Providing Educators with a Real-World STEM Experience

*Dana Backman<sup>1</sup>, Coral Clark<sup>2</sup>, and  
Pamela Harman<sup>1</sup> <sup>1</sup> SETI Institute, Mountain  
View, CA <sup>2</sup> USRA, Mountain View, CA*

NASA's Stratospheric Observatory For Infrared Astronomy (SOFIA) is the world's largest flying telescope. On board, scientists leverage SOFIA's unique capabilities to study the universe at infrared wavelengths through observations that are impossible for even the largest and highest ground-based telescopes.

SOFIA is an extensively modified Boeing 747SP jetliner that carries a reflecting telescope with an effective diameter of 2.5 meters (100 inches). Astrophysicists use the observatory and continuously upgraded instruments to study astronomical objects and phenomena, including star birth and death, formation of new solar systems, identification of complex molecules in space, planets, and comets.

## Ryan Munkwitz

Long Island, New York

Ryan Munkwitz teaches 11th and 12th grade Astronomy, as well as 8th and 10th grade Earth Science in two different schools in the same district on Long Island, New York. His astronomy classroom doubles as a planetarium, and this allows his students to look at astronomical events on a daily basis.

He has been able to translate his experience as a SOFIA Airborne Astronomy Ambassador directly to his classroom.

*"I can simulate any time of day or night or latitude, longitude, location on earth or even in the universe. We can kind of fly out and simulate our position that way. It is really a very powerful tool and I love using it. SOFIA has definitely helped to*



# Science **SOFIA** Airborne Astronomy Ambassadors Program

*bring some light onto the conversation when it comes to what we are talking about in my astronomy class, as well as earth science and even the general public in the*

*members have approached me to talk to me about it and I love it.”*



*community of Southampton. I have just participated in this, so many parents and community*

The experience of riding on the SOFIA aircraft was exhilarating and it allowed Munkwitz to see first hand the techniques and tools currently being used by scientists in the field to collect and process data.

*“I had to keep checking my pulse to make sure I wasn’t going to have a heart attack or something, because it really was exciting and it was just beyond belief, being onboard, especially the very first time you are walking on and you see everything, and you are just trying to take it all in. It was incredible, the whole experience, and it just kind of gives me goose bumps every time I talk about it. It is really powerful.”*

*I learned more about what current astrophysicists are doing with their research and how they are collecting it and the data processing and the procedures that they are following and the mechanics of the telescope and techniques that they are using.... it was understandable how they were making it applicable as compared with beforehand when I wasn’t as clear on how all*

*of it genuinely worked.”*

Munkwitz’s participation in the SOFIA project, in conjunction with professional development related to the Next Generation Science Standards and the Common Core State Standards, has impacted his teaching practices to include more experiential and student driven lessons. He has shifted his practice to having his students take on a more active role in doing research and gathering their own data.

*“It is something that I continue to work on and it is not perfected by any means, but it is definitely well underway compared to where it was beforehand. The whole NASA experience, the professional development to help me to see the bigger picture and think about how I need to get my students more practiced in inquiry and finding the information for themselves and actually making that effort real. The Next Generation Science Standards talk about developing*

*inquiry and using rubrics and self assessments and then having the NASA component and looking at the whole thing together made me sit down and realize, working like scientists, collecting their own data and going out there and finding it for themselves makes it more real and a genuine experience.*

*It is more applicable to them in the long run to generate those lifelong skills toward college and career readiness... and the national standards that are appearing we need to try and achieve as well. It definitely helped... the NASA SOFIA experience really tied it all together for me."*

One of the ways in which Munkwitz has contributed his knowledge and experience to the broader field is by presenting at the most recent NSTA meeting in Boston. He ran a workshop with SOFIA Airborne Astronomy Ambassadors program co-manager Pamela Harman (SETI Institute, Mountain View, California), and together

they showed off some things that Munkwitz has been doing in his classroom, as well as sharing other experiments that have been created to showcase the SOFIA technology and ways of applying it in the classroom.

At the conference he shared a lesson that he developed through his participation in the SOFIA program.

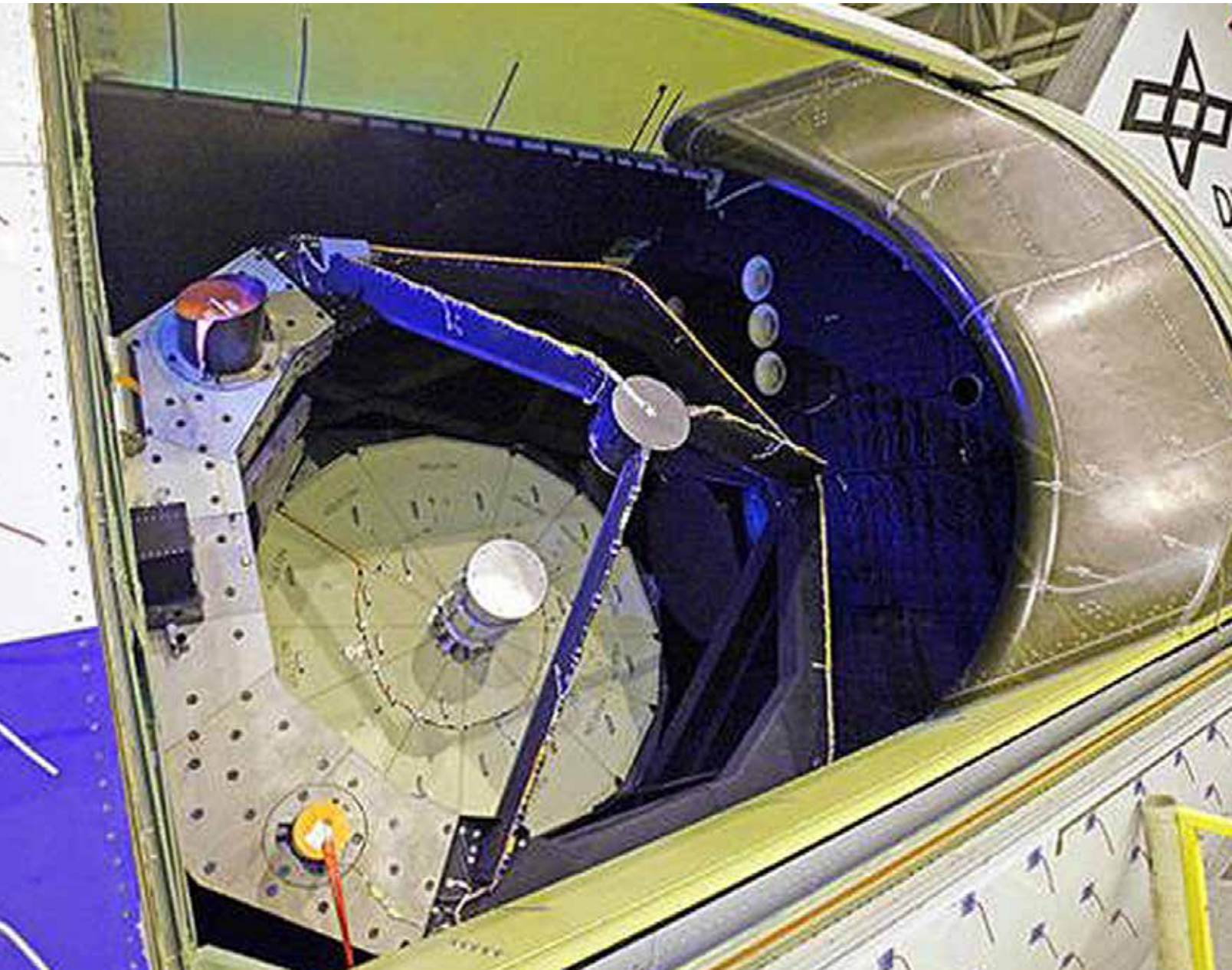
*"I have them [students] build their own spectroscope using very basic tools, like a cereal box and I have a roll of diffraction grating. They build their own spectroscope and then use a device we have where you can ionize different gases in a tube and you can look at the spectra for a range of different elements.*

*We do that in the classroom and we are analyzing the spectra because that is really what scientists are doing in astronomy, they are certainly looking at the spectra and onboard SOFIA, they were analyzing spectra of different stars and globular clusters and other areas, like the central black hole of our galaxy. It really all boils*

*down to what the spectra is telling you and knowing what the wavelengths are.”*

In addition, to attending the conference, Munkwitz has shared the same lesson in Southampton at board meetings and with other school districts. The high school community science nights have generated more interest since the teachers’ participation in SOFIA.

*“There have been three community science nights in our high school since SOFIA and there was a huge buzz, especially right after we came back at the first one. There were a lot of people and we shared our experience and we had a short PowerPoint.”*



*I put in some of the pictures that I had taken during our trip and it generated a huge conversation where people were ecstatic to know that the teachers teaching their children were involved with NASA and it just brought this huge intense joy to the whole community.”*

It is apparent from talking with Munkwitz that his participation in the SOFIA program has been of tremendous value to him both personally and professionally, as well as bringing excitement to his school and community.

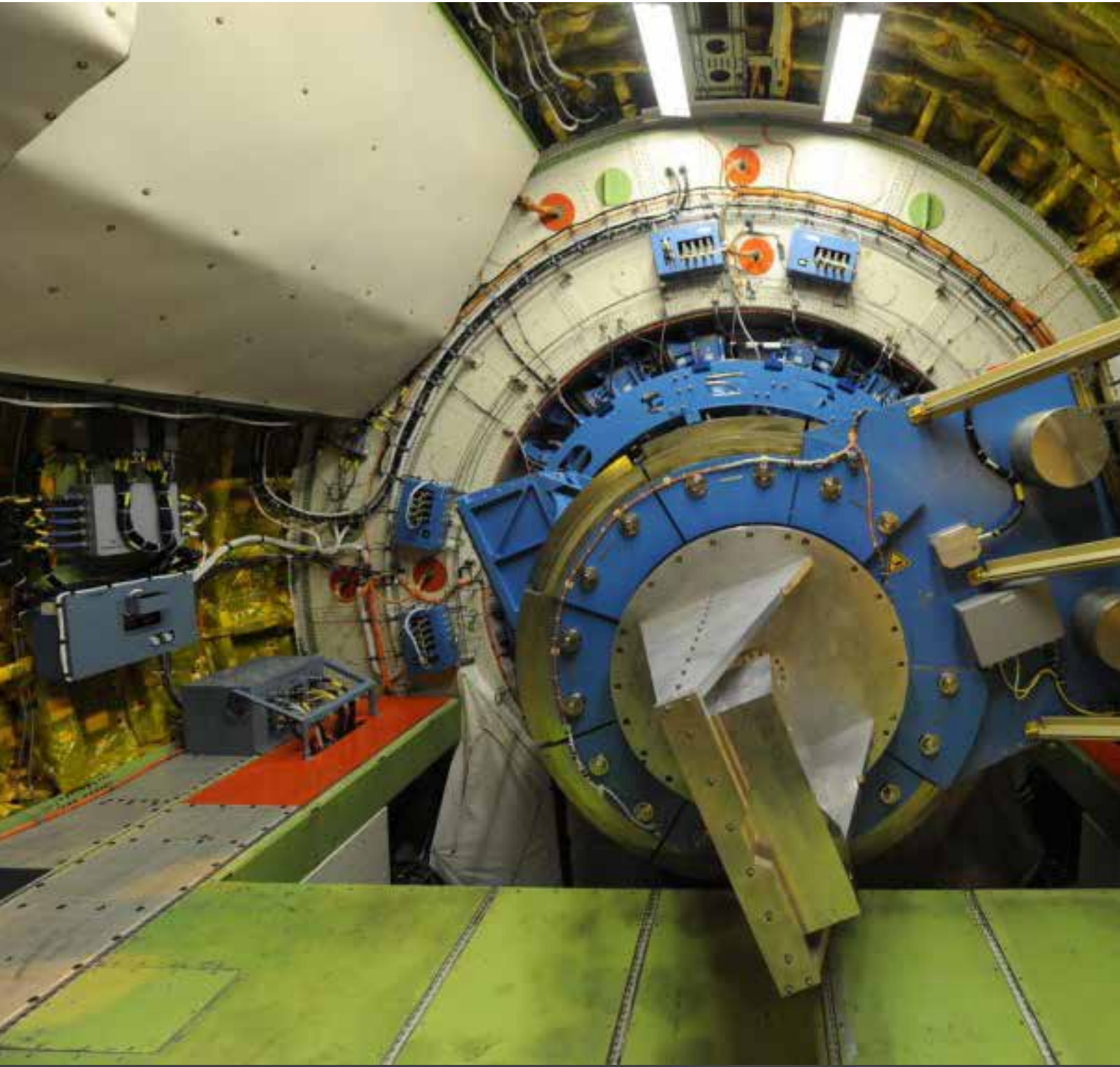
Munkwitz says he definitely gets the feeling from some of his students that they look at him and think, “If my teacher can achieve this, why not me?” He is overwhelmingly grateful to have been given the opportunity to be a SOFIA Airborne Astronomy Ambassador.

*“It is surreal and it was just incredible to be able to get on a NASA aircraft and say that you were able to participate in flying onboard with NASA scientists, doing real research and collecting real data. It was such a meaningful thing.”*

## Chelen Johnson

Minnesota

Chelen Johnson teaches Advanced Biology to 10th graders, and Astronomy, Astronautics and Environmental Science to 11th-12th graders at a high school in Minnesota. She took two flights on SOFIA in February 2013 and described it as “a dream come true.” One of the most important outcomes of these flights was that the experience reinvigorated Johnson’s desire to work with the space science program. This ultimately led to her co-authoring, with an astronomer, a research proposal that was accepted for a future SOFIA flight.





The SOFIA team encouraged her to apply for a research experience for teachers through the National Radio Astronomy Observatory (NRAO). In summer 2013 she had a nine-week internship where she conducted astrochemical research, looking for new molecules in space. During this time, she also co-authored the successful research proposal for SOFIA.

Johnson has used her SOFIA experience to enrich her classes. She has shown some of the on board footage to her Astronomy, Astronautics, and Environmental Science students.

When she was on SOFIA, scientists were investigating how a new focal plane imager worked. They were able to look at a very common object, like Beetlejuice, and see it using the three different imagers. She says that because the foundational science is not highly technical, her students can understand it.

*“They understand what Beetlejuice is and they understand what a star cluster is... but they wouldn’t necessarily understand without a common background.”*

Johnson’s SOFIA experience is directly relevant to her teaching on Saturday mornings when she works with her Girls Astronomy Club. Four girls joined last year and followed Johnson’s flights while she was on SOFIA. Four more joined this year and now all eight junior and senior girls meet with Johnson every Saturday morning to analyze and making meaning of astronomy data.







OBSERVATORY  
RONOMY

LARRY  
THE UNIVERSITY OF TEXAS AT AUSTIN



They started by looking at data from SOFIA and then moved on to data from the Spitzer Telescope, another project with which Chelen has been involved. The Astronomy club collaborates with a couple of other schools and this year the girls published a poster, based on their Spitzer work, at the American Astronomical Society conference.

Johnson also shares her experiences with the larger community. She provided an astronomy evening as a prize for her school fundraising auction last year (*she said she was very humbled that high powered people would want to spend a night talking about nerd stuff!*) and has written quite a few articles and given talks for community publications and television shows about SOFIA and why it is important.

*“There is always at least one person who asks, ‘Why do we need to spend millions of dollars putting a telescope on an airplane?’*

*I love it when people ask that because that is when my passion really comes out. I tell them, if we never went to the moon, we wouldn’t really know, we would just wonder. We have to satisfy that curiosity somehow and this is a way to help put together the puzzle of what is our earth and what is it like in different parts of our universe.”*

**Information for educators interested in 2015 will be posted on the SOFIA Science**



**participating in SOFIA's Airborne Astronomy Ambassadors program in  
nce Center's website.**

**SOFIA AAA team applications are due December 22, 1014.**

**<http://www.sofia.usra.edu/Edu/edu.html>**

# CLASSROOM IN THE CLOUD:

## Smartphones Are About to Get Smarter

*Dr. Gene Levinson*

Machines don't teach people. People teach people. The same can be said of technology, and I agree that people are the principal ingredient.

Without dedicated and effective teachers, technology is not helpful. Teaching can take place in person, of course, and all other things being equal, this would be the preferred method. Over 30 years ago, Bloom made a striking observation, now known as Bloom's 2 Sigma Problem: when students were tutored one-on-one, using mastery learning techniques (such as learning from mistakes, a.k.a. formative assessments) they performed two standard-deviations above the norm seen with traditional learning methods.

Yet most of us know from personal

experience that even the most dedicated and effective teachers have limited time available for one-on-one instruction in the classroom. One-on-one tutoring for the masses has other limitations such as logistics and cost.

As a professional K-12 tutor (mostly high school) with literally thousands of hours of one-on-one tutoring experience, I know how effective tutoring can be, but I also know that as a professional tutor, I can reach perhaps two hundred students per year. Yet there are millions of students who are not getting what they need in the classroom. What about them?

And yet... we now have this remarkable technology known as the Internet, and smartphones and other mobile devices, and the

majority of high school students have them, carry them everywhere, and use them throughout the day.

So the question is, can we use mobile technology effectively to bring millions of students together with dedicated teachers, tutors, and educators, even if not in person?

Can we replicate some of the principles of effective teaching, including learning from mistakes, inquiry-based learning methods, growth-oriented rather than fixed mindset, teaching study skills to students, and help them learn prerequisites missed in earlier years? Can we also help empower parents to help their own kids with homework, especially in S.T.E.M. subjects in which the parents may themselves struggle?

I strongly believe that we can accomplish all of these things with mobile technology, and that is why I founded SmartNoter, and why we have released an app to the general

public, even though we realize that we need much, much more content to realize its full potential. *(If you are a teacher or school administrator and would like to use SmartNoter for a pilot study in your school, please contact me).*



**Problem 1:**  
*Students Are Limited By One Classroom, One Textbook, One Teacher Per Course.*

Imagine you are a high school student studying Algebra 1 or 2, or Biology, or Chemistry, and you are just not learning the material in the classroom. There are far more concepts and vocab to learn than the teacher could possibly pack into lectures, even when they are effective. Only in this particular

class, it turns out that they are not. Outside study resources are limited: the school has not even bothered to issue a hard-copy textbook, and the web-based online text used by the school district is

so bad that everyone in the class has given up on it—including the teacher himself. Sound familiar?

### **Our Mobile Solution:**

The free SmartNoter app (the first release is already in the iTunes App Store) will provide complete supplements for standard middle and high school S.T.E.M. courses that include short videos (called SmartCasts), Concepts, Vocabulary, and Practice Tools to support teachers, students, and parents.

These are fine-grained, carefully vetted original content by master teachers that present the subject matter in a crystal-clear way.

The content will be comprehensive, fully cross-referenced and instantly search-able. Course content will be extremely affordable and readily accessible for courses such as Pre-algebra, Algebra 1 or 2, Biology or Chemistry with free updates.



I did well in math. So why can't I help my own kid with his homework?

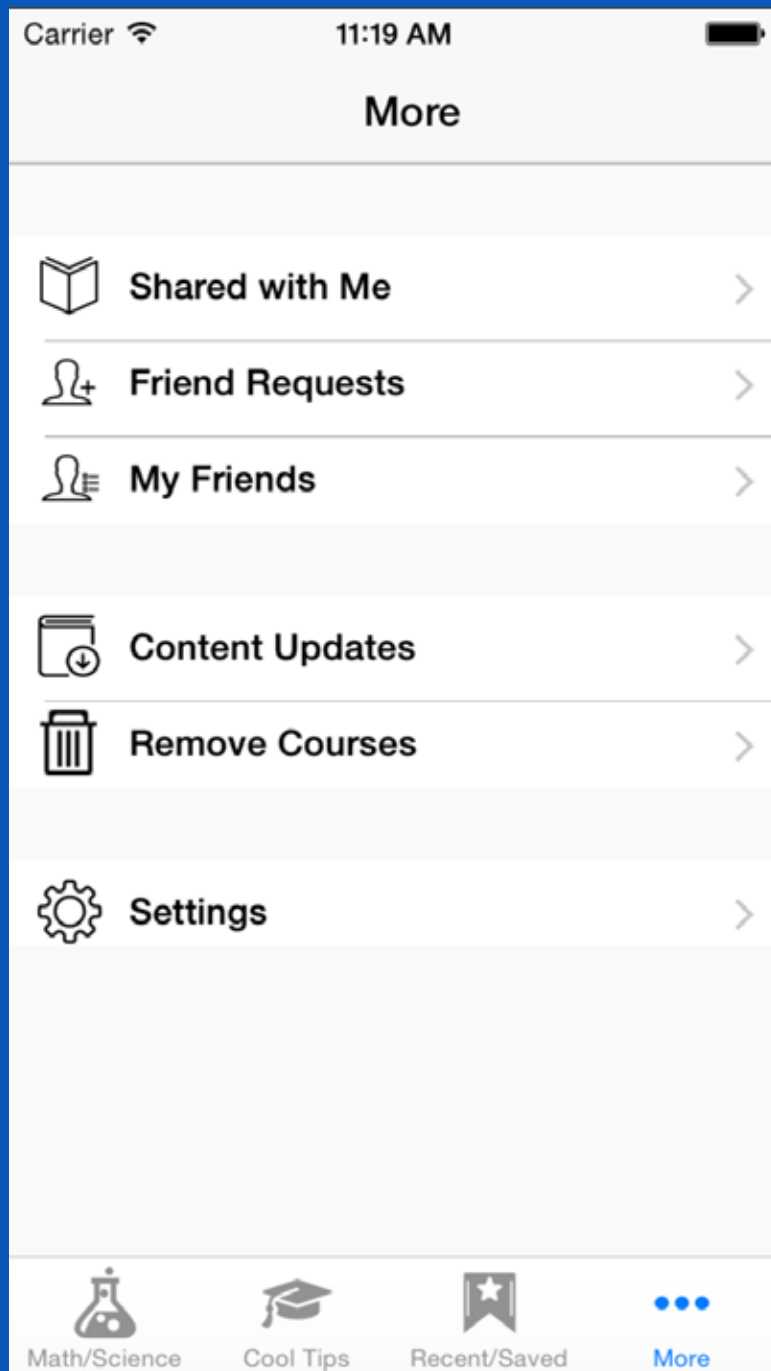
If I tell Mom I just don't get fractions she'll think I'm stupid or something...



**Problem 2:**  
*Parents Have Limited Time and Resources to Help Kids With Homework*

Or perhaps as a parent with kids in middle school or high school, you are experiencing this not first-

hand, but in an even more painful way—seeing your own bright, creative kids losing that sparkle in their eye, and learning to hate math or science. You sit down with your kids to support them and help them with their homework—even though you have little time to



do this, what with work and other family responsibilities—but when you do, you realize that the homework and review sheets for the exam either cover topics that were never even mentioned when you were in school, or it has been so long since you used what you learned the material that you have forgotten the basics, even if you were a straight “A” student in high school.

### **Our Mobile Solution:**

The SmartNoter app has powerful sharing capabilities that allow parents to look up, share, and discuss precisely the same materials in either the same or in remote locations.

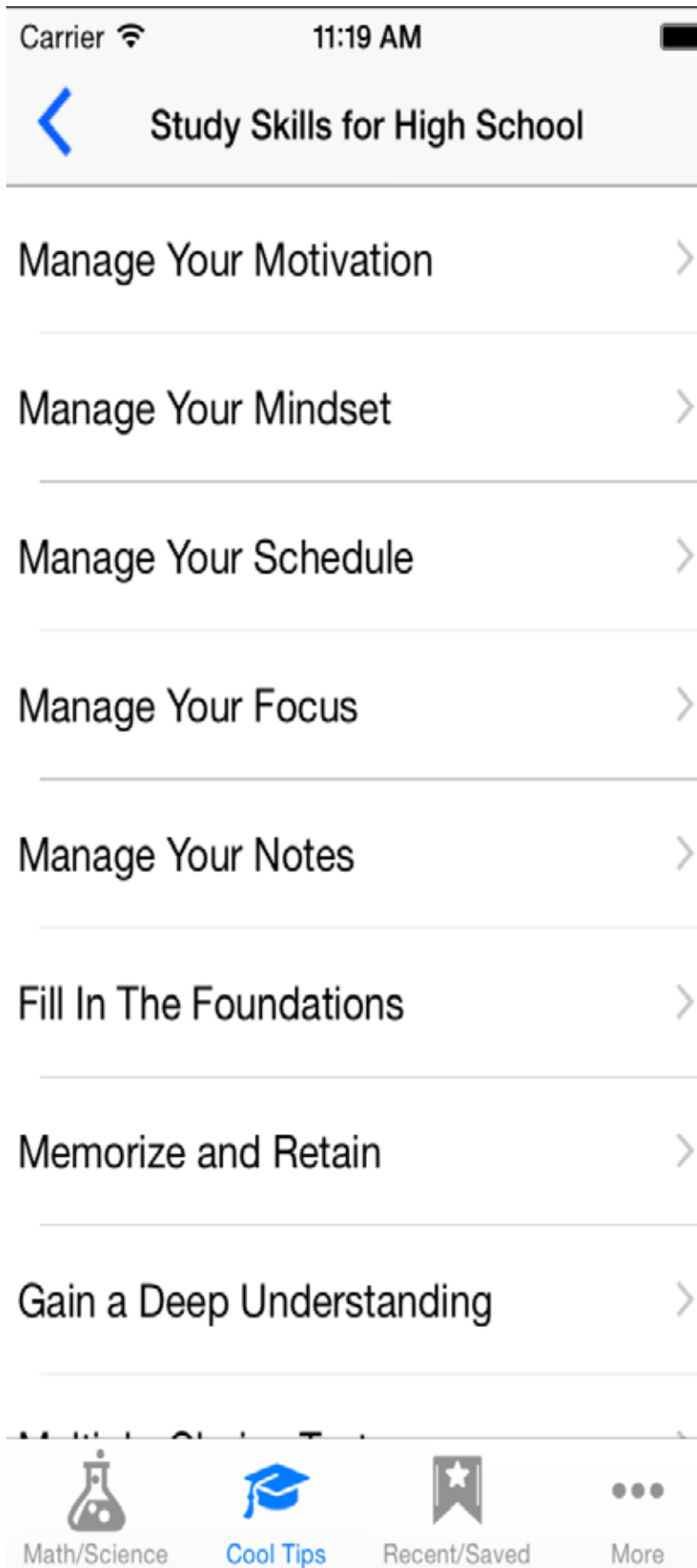
Finally, there is a simple way that parents can find reliable course information to help their own kids with their homework.





If your student is a girl, you are almost powerless to do damage control when your daughter first hears from one of her friends that “girls are not good at math,” and you stand by helplessly as you know that hearing that stereotype even once puts your daughter into a fixed mindset (reference) in which she is distracted by her fear of failure, and therefore is not able to focus on the material and learn it in the first place.

[www.smartnoter.com](http://www.smartnoter.com)



## Our Mobile Solution:

> The SmartNoter app has a free Cool Tips feature that includes Study Skills, including down-to-earth, friendly suggestions about how students can master good study habits and also manage their own perspectives, mindset and motivation in constructive ways.

### > **Problem 3:**

*No Opportunity for Kids to Learn What They Missed in Earlier Grades*

> If you are, say, an Algebra 1 teacher, you have probably experienced the frustration of discovering that many, perhaps most of your students have not learned basic math foundations, such as operations with negative numbers or times tables, that provide the essential understanding and problem-solving capabilities required for more advanced subjects. You also realize that even if you work extra hours, there are not enough

contact hours with the students at school, in the classroom or out, to help them learn what they missed in earlier years.

**She's trying so hard. This just breaks my heart... I have less and less time to give her the individual attention she so desperately needs.**





Course > Unit > Topic

## Calculating negative powers

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

$$3^{-4} = \frac{1}{3^4} = \frac{1}{81}$$

$$10^{-2} = \frac{1}{10^2} = \frac{1}{100}$$

### Prerequisite Concepts

[Calculating exponents using repeated multiplication](#)

[A number's reciprocal is 1 divided by the number](#)

### Related Concepts

[Calculating powers of negative numbers](#)



## **Our Mobile Solution:**

The SmartNoter app will routinely provide cross-referenced materials that make it simple and painless for students to quickly search for, and locate, the relevant, prerequisite materials that they need for their current assignments, so that they can keep moving forward while rebuilding those essential foundations.

Mobile devices have provided the means, and we have the motive and opportunity to engage in a mobile educational revolution so powerful that it will forever change what students can learn not just within the classroom, but also beyond.

When students take ownership of their own learning, and see their objective as mastery of the material, not just turning in homework assignments... when those students are no longer limited by what goes

# **“The Future of Education is Very Bright ...”**

Mobile devices connected to the Internet (cloud technology) have truly become part of our daily lives, for adults and children alike. Just look to your left and right in any public place where people have a few moments free. What do you see in their hands?

If you have read Malcolm Gladwell's book, *The Tipping Point*, you might imagine, as I do, that we are on the cusp of an incredibly positive change in education.

on in any one classroom, but begin to connect with thousands of high-quality educators from all over the world... that is when we will see education propelled to levels that we cannot even yet imagine.

**Don't Block the Light!**

We now have an incredible window of opportunity in mobile devices. Most kids have them, love them, and use them constantly.

I propose that smartphones are, in fact, the beginning of a major change in education, for the better.

What if this is truly a way to connect millions of students with thousands of caring, dedicated, and talented teachers, tutors, and other educators. Why should students be limited by any single classroom experience?

I believe that apps such as:

## **SmartNoter**

are just the first wave in a sea of change in public education at global proportions. I am certain that the future of education is very bright.

---

*Dr. Gene Levinson has reinvented himself many times: as a research scientist, who discovered in 1987 how DNA expands, as a Clinical Researcher who made it possible for parents who carry genetic disorders to have healthy children of their own, as an award-winning tutor who tutored Harvard students for three years and then went on to set up a successful*

*tutoring practice with over 250 five-star ratings, and now as an entrepreneur.*

*You can read more about him on his LinkedIn profile. His startup social enterprise, SmartNoter Inc., has released its first product, a free iPhone app to the iTunes store with more course content coming soon.*





# PHANTOM 2

The advanced flight technologies of the Phantom 2 Vision , easily upgradable into an aerial video powerhouse with our silken Zenmuse H3-3D gimbal .



## ZENMUSE H3-3D

Smooth video even during buffeting winds and intense maneuvers. The camera 's tilt can be controlled directly from the remote control, adding another level to aerial shoots.

Designed for the GoPro Hero 3 and Hero 3+, the Zenmuse H3-3D keeps the GoPro tight and secure.



## IPAD GROUND STATION

iPad ground station software turns the Phantom 2 into a fully automated flight system.

## A FULL FPV EXPERIENCE

Get the full FPV experience with the iOSD Mini mark II including telemetry and flight parameters.

