

# INTERDISCIPLINARY INNOVATION:

## ADDS ART AND DESIGN TO THE EQUATION

On a bright, seasonally warm morning this spring, Harrisburg Academy's 7<sup>th</sup> and 8<sup>th</sup> grade students clustered on the upper athletics field, paying close attention to the instructions of David Brason '74. Brason, a guest through the Academy's Distinguished Leaders in Residence program, was preparing to facilitate an interactive, creative-thinking simulation with the students.

The assignment — "Design...Build...Destroy!" — divided the students into five teams and provided each with a standard set of building supplies, including two rolls of duct tape, six PVC pipes, three 6-foot-long, 2-by-2 boards, three cinder blocks, rope, string, and 100 tennis balls. The students were tasked with using these supplies to build a structure that would house the tennis balls three feet off the ground and safely withstand an "assault." In addition, the teams were given \$180 in fake project money to buy additional items they felt would strengthen their efforts, including cardboard boxes, buckets, Gorilla Tape, and additional quantities of the original materials.

Forty-five minutes later, the "assaults" began. Opposing teams attempted to destroy competitor contraptions, pelting them with various athletic balls and water gun blasts. The groups able to keep the most tennis balls safely contained (taking into account some "handicap" scoring for projects with additional supplies) would win.

Team "Supreme" took top honors with its sturdy, creative design and its smart use of resources. Much like a suspension bridge, this design drew on the strength and balance of triangles and expertly placed guy-wires along with a wide base and a tennis ball

compartment completely sealed off with duct tape. And while team Supreme did retain all of its tennis balls, it won because it made use of the least amount of resources.

### STEAM DEFINED: AN OLD CONCEPT RENEWED IN MODERN TIMES

The Academy's Distinguished Leaders in Residence activity, albeit simple in scope, represents a larger school of thought in problem solving — the idea that **understanding** is much more powerful than **knowledge**, itself, and that consequently, a well-rounded individual who understands a problem is better able to consider resources at hand, apply technical knowledge and skill, and work collaboratively with others to solve the problem in a new and different way. The involvement of art and design in this discovery process is paramount, even though many in today's society see it as divergent from a more traditional technical approach.

Shirley Malcolm of the American Association for the Advancement of Science (AAAS) spoke on this exact topic at a national conference hosted by the Rhode Island School of Design (RISD) in January of 2011. "Why was this artificial bifurcation made [between art and science] and how can we reconnect it?" Malcolm posed to her audience, referencing innovators like Leonardo DaVinci who were incredible contributors to society in both science and the arts. The goal of the National Science Foundation-sponsored conference, "Bridging STEM to STEAM: Developing New Frameworks for Art-Science-Design Pedagogy," was to bring together many of

today's great minds to examine and discuss ways in which we can enhance Pre-K-to-16 STEM (Science, Technology, Engineering, and Math) education by integrating art and design — STEM + A (Art and Design) = STEAM.

So what is STEAM, exactly? According to Penn State Harrisburg communications department chair and associate professor of humanities, Catherine Rios (mother of Mira Witwer '24), the Arts portion of STEAM is the "scaffolding" that supports the ultimate success of any given Science, Technology, Engineering or Math innovation. Artists and designers are critical in the creative process, Rios said, because they have expertise in finding "form" for a project's content and function.

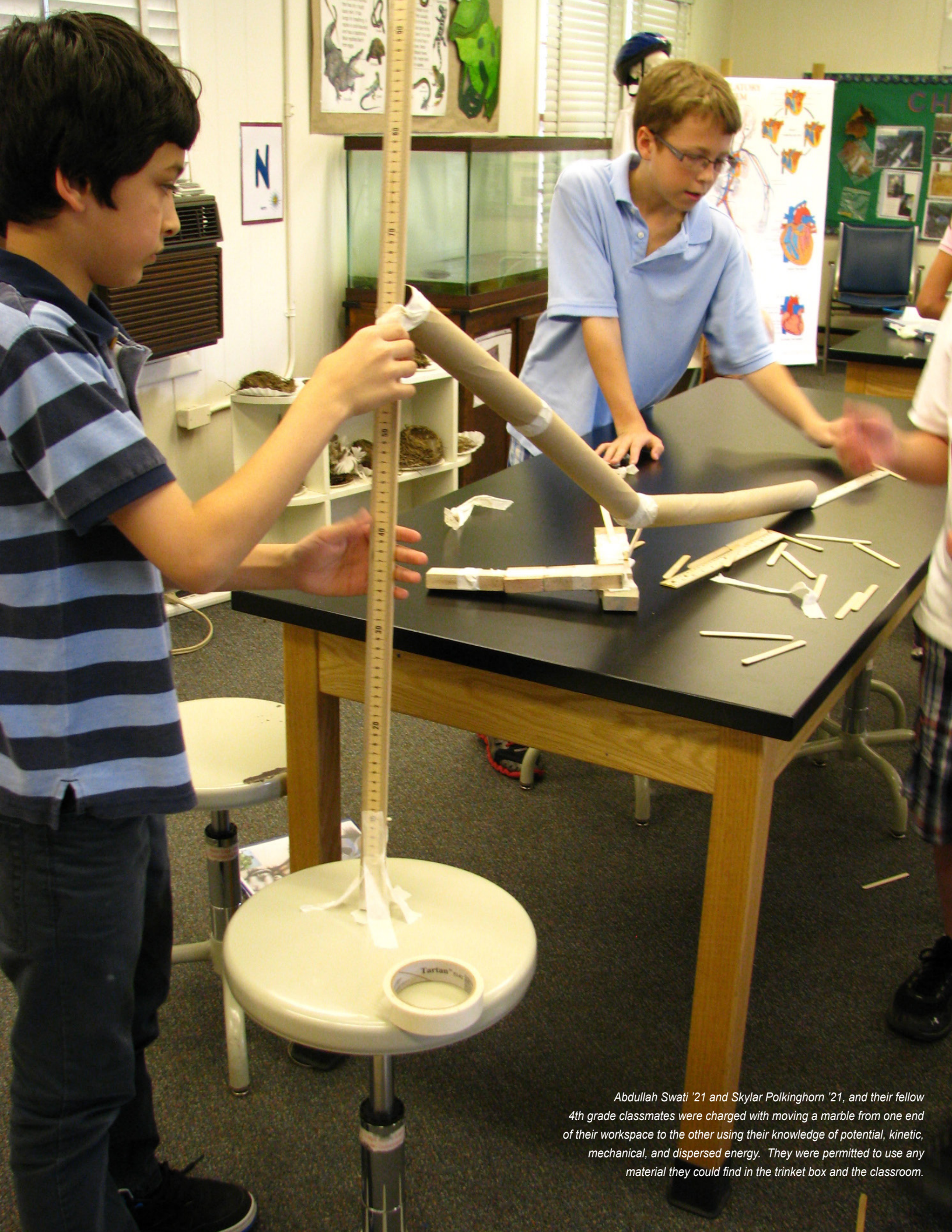
"If the form of your idea does not relate to the content and the function, your concept won't succeed," she said. "Even the simplest of concepts has to find some form to be conveyed to a very broad spectrum of people. The goal of STEM-to-STEAM is the idea that we foster true innovation by combining the more technical disciplines (content and function) with the design (form)."

But this concept is not just the simple addition of arts education to a school's greater menu of technical classes, said Margaret Honey, president and CEO of the New York Hall of Science and an additional presenter at the "Bridging STEM-to-STEAM" conference. "It's about fundamentally changing education to incorporate the experimentation and exploration that is at the heart of effective education."

Harrisburg Academy is uniquely able to do just this, because the philosophy of STEAM is at the core of the school's liberal arts

*continued on page 4*





Abdullah Swati '21 and Skylar Polkinghorn '21, and their fellow 4th grade classmates were charged with moving a marble from one end of their workspace to the other using their knowledge of potential, kinetic, mechanical, and dispersed energy. They were permitted to use any material they could find in the trinket box and the classroom.





Academy alumnus, David Brason '74, facilitated an interactive activity for 7th and 8th grade students during the Academy's Distinguished Leaders in Residence event. Pictured here (clockwise, from bottom left): Yoav Shavit '17, Sara Sherman '17, Chase Wallace '18, TaChae Range '18, Owen Foley '17, and Noah Sweeney '18.

*continued from page 2*

identity. How? The Academy is free from the constraints of publicly funded schools and in this position, is able to create a curriculum that is integrated, comprehensive, and encourages a mastery of understanding, not just a mastery of knowledge. Math instruction beginning in HATS logically leads into Junior Kindergarten and Kindergarten math, progressing through Lower School, and continuing up through Middle and Upper School, all the way to International Baccalaureate Higher Level mathematics. The school provides a unified, progressive 15-year experience in each academic subject. Additionally, the Academy integrates learning cross-subjects, tying lessons experienced in computer science class to skills learned in fine arts class, and using graphic design skills to better demonstrate topics being analyzed and presented in history and English classes. Because the Academy is not bound to “teach to the test,” its students are afforded time to delve into more complex problems, foster creative thinking and collaborative solutions, and in turn, develop the “deep learning” skills needed to succeed in the 21<sup>st</sup> century — skills that will set them apart from others when applying to college and competing for graduate schools, top jobs, and beyond.

“My daughter’s whole learning experience is totally integrated,” Rios said. “Harrisburg Academy doesn’t have to segregate learning

outcomes from the learning process, and I think that is the model of what interdisciplinary STEM-to-STEAM is.”

## STEAM CONNECTIONS IN THE CLASSROOM

The STEM-to-STEAM movement is indeed gaining momentum across the globe. Educational institutions, corporations, and individuals are embracing innovation as a way to ensure our nation’s prosperous future. John Maeda, RISD’s president and unofficial founder of this movement, even goes so far as to claim that art and design are poised to transform our economy in the 21<sup>st</sup> century just as science and technology did in the last century. And it all starts with interdisciplinary education in primary and secondary schools.

STE(+a)M Connect, a respected think tank of scholars, educators, and artists committed to informing about and advocating for STEAM education, states that complex problems are best solved using both hemispheres of the brain. By blending “immersive arts programs with reading, calculation, spatial reasoning, and critical analysis from a high-level viewpoint, educators are able to encourage development of forward-thinking, multi-sensory problem solving abilities in their students,” says the group. And the outcome of being educated

through a well-balanced liberal arts curriculum? Individuals who are well-rounded, global citizens who are able to apply their knowledge in inventive ways to conquer new challenges.

“I love the fact that my son is being exposed to the arts and artistic expression, and is being taught that the arts are important,” said Jeff Ritchie, digital communications department chair and associate professor of digital communications at Lebanon Valley College (father of Colin ’26). “If you’re going to be an adult who creates something elegant that makes people’s lives better, improves the world, or impacts the bottom line, art matters! The fact that Colin will be exposed to this, in addition to inquiry-based science, at a young age — that is phenomenal.”

Ritchie continued, “I want Colin to learn that being wrong is OK and that failure is to be expected, too. This resilience is a key part of the process of innovation. ‘Fail Early... Fail Often... Fail Forward,’ is what I say.”

Indeed, by definition, the courage to take risks and face failure is an essential component of STEAM. “Curiosity and imagination are undoubtedly wellsprings of innovation,” says Tony Wagner in his 2012 book, “Creating Innovators: The Making of Young People Who Will Change the World.” But Wagner also identifies the importance of a student’s perseverance, willingness to experiment, ability



to take calculated risks and tolerate failure, and use of “design” thinking (in addition to critical thinking) to discover new solutions.

We see this every day at the Academy. There is no better example than Lower School science class, where the Kindergarten-through-4<sup>th</sup> grade students of Carolyn Estill-Shover '92 (mother of Taryn '22 and Jeremy '24) explore and innovate on a small scale in their dedicated lab science class. Children are encouraged to question what they see and to bring these questions to class. Estill-Shover keeps a few large boxes of odds and ends, trinkets, and whimsical, cast-off items for use in this student-led experimentation, addressing questions posed by their classmates.

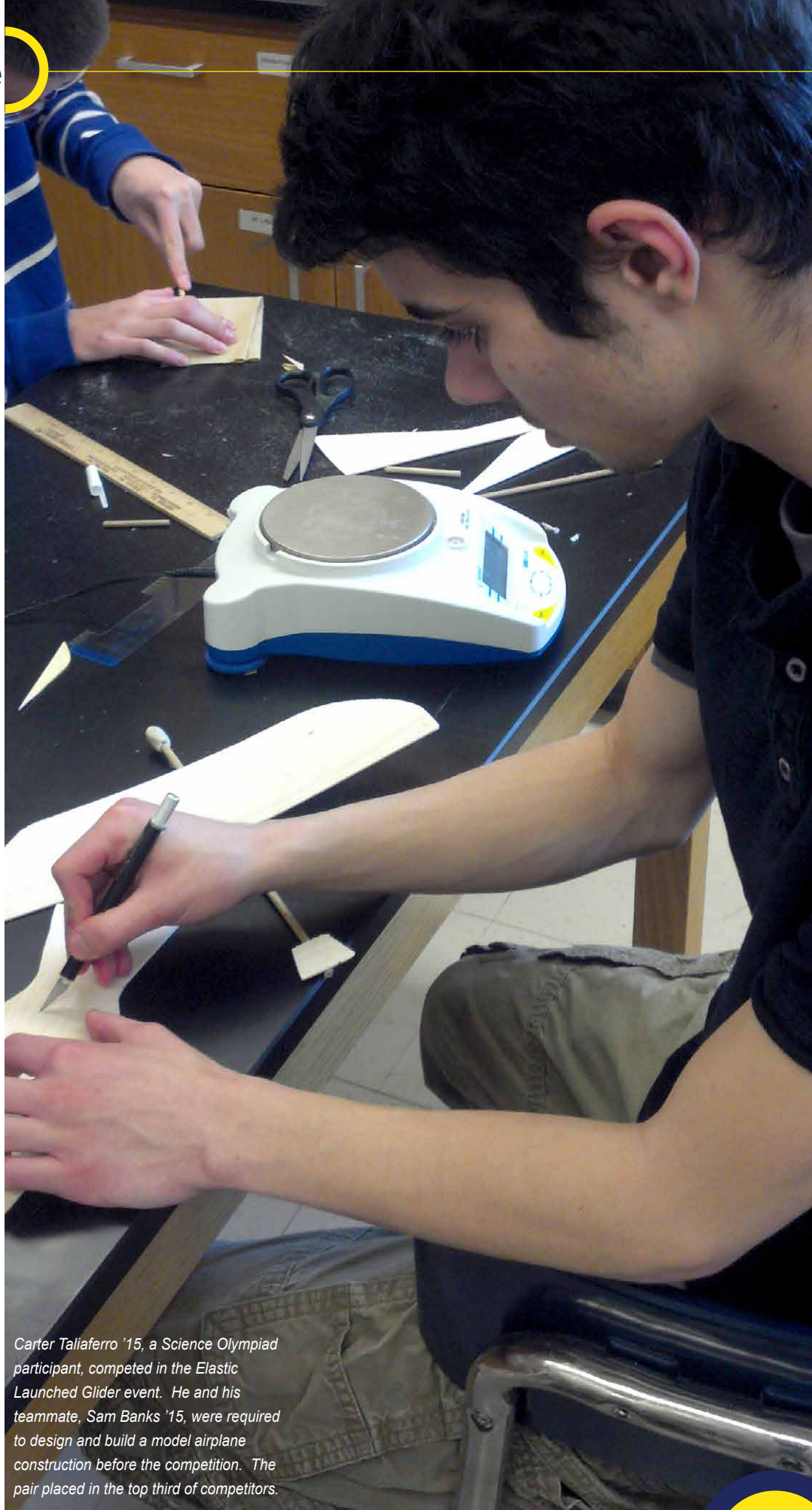
“I tell the students, ‘My boxes are available to you,’ and I ask them, ‘What do **you** think we need to figure this question out?’” Estill-Shover said. “Many times, I already know that the experiment they’re designing on their own won’t work, but I won’t tell them this. I want them to have the opportunity to figure it out. Then I help them determine the reasons why they didn’t get the answer they might have expected and why their design failed. And sometimes, we try again — because they are so determined!”

“Ultimately, I want my students to be able to understand and explain the world around them,” she continued. “It is so important for them to be able to make connections between science here and the greater world. As their teacher, I provide them with the knowledge and guide them in how to use it. But my true goal is to ignite their own desire to figure things out.” This philosophy is not unexpected, given Estill-Shover’s own educational background as a once inquisitive and engaged Academy student herself.

Add a few more inches in height and more candles to the birthday cake, and you’ll see students eager to apply their knowledge and deep understanding of their favorite subjects in creative ways in the Academy’s Middle and Upper Schools. Mary Toth (mother of Alison '16, Krista '18, and Michael '20), science teacher and director of the Academy’s Center for Experimental Sciences, mentored 13 Upper School students for the regional Science Olympiad competition at Millersville University this spring. Science Olympiad draws competitive teams of students from neighboring schools who are interested in science and who cross-train for a variety of events in their skill set for months before competing.

Many Science Olympiad events require students to complete “constructions,” or models, ahead of time, which they bring with them to the competition for additional work and judging. Although certain parameters must be met, there is much creativity in the actual design process (originality which has direct bearing on the effectiveness of the design). Harrisburg Academy’s thermodynamics challenge

*continued on page 6*



*Carter Taliaferro '15, a Science Olympiad participant, competed in the Elastic Launched Glider event. He and his teammate, Sam Banks '15, were required to design and build a model airplane construction before the competition. The pair placed in the top third of competitors.*



*Image used with permission from Camilla Hallgrén.*



*continued from page 5*

participants, Philippe Rivera '13 and Luke Bent '13, were asked to construct an insulated device that would retain heat and fit a 250 mL beaker holding water. Bent and Rivera chose to construct their device using a cardboard box covered with aluminum foil, stuffed with wool. After extensive testing and collaboration with fellow students, Bent and Rivera were ready to take their device to the competition — and their creativity was rewarded with a first-place win!

STEAM at the Academy is so much more than just creative problem solving, savvy methods of construction and presentation, and student collaboration in the more technical subjects — there is the human element. Problem-solving skills also impact our society's ability to tackle large-scale, global social issues, oftentimes requiring new and different means of analysis and action. The Spring 2013 Independent School magazine article, "Meaning and Utility: Keeping the Humanities and Global Education Central to Learning," touches on this idea. The authors claim that a STEAM-focused

education "prepares students for citizenship and leadership roles in a world in which they will need to assess and debate economic, technical, scientific, and moral questions that have profound consequences for all of us.

"Where would engineering and human invention be without the beauty and creativity of the arts?" they say. "How would communities thrive without historical knowledge of the archetypes conveyed in great literature? Where would scientific and technological advances be without Socratic inquiry? How can we develop a moral compass in life without a careful study of history and literature? To nurture a better dialogue across the entire range of academic disciplines, educators should begin to ask new and more probing questions as they create curricula that help acknowledge the generative link between STEM and the humanities."

Terry Bowie's methodology to teaching Upper School art at the Academy demonstrates this idea of creativity and out-of-the-box problem solving tied to the human purpose. Although hands-on creation is still at the core of his

*Terry Bowie's IB Art class skyped with Swedish artist and Stockholm University professor, Camilla Hallgrén, to discuss her miniature artwork and the global social issues explored through it. The Academy students wrote papers about the issues and created their own miniature artwork in the style of Hallgrén. Shown above, Hallgrén's piece, "Life is a journey."*

instruction, Bowie has expanded curricula to include a diverse array of teaching methods and means, involving global connections along the way, thanks, in part, to technology.

During a trip to a local bookstore this spring, Bowie purchased a copy of an art magazine featuring "Little Sweden Art," ([www.littleswedenart.com](http://www.littleswedenart.com)) the work of Swedish artist Camilla Hällgren. Hällgren is an art educator at Stockholm University who creates thought-provoking scenes — making playful, yet profound, social statements — with miniatures juxtaposed to everyday objects. Bowie fell in love with the artist's work and her statements on big social issues being explored through this miniature art shot on a macro scale.



*A response piece by Academy senior, Xiang Li '13. Li purchased a set of figures and shopping carts, intending to make a statement about commercialism. Says Li in her IB Art Journal: "The shoppers and toothpaste originated from the relationship of salesmen and customers. I tried to convey that the salesman spent too much effort on customers, and that they promote their products just to promote. This project has marked a cornerstone of my 'journey' as an artist."*

A week later, much to his delight, Bowie took notice that Hällgren was following his own work through the social media platform, Instagram. The two exchanged some complimentary emails, and Bowie took the connection further, introducing his IB Art students to Hällgren's work and to the artist, herself. The students viewed her artwork and wrote reaction papers, which were shared with both Bowie and Hällgren. They also were charged with purchasing 12-millimeter model train figures and creating a set of their own artwork in Hällgren's style. Then the

class Skyped with Hällgren to continue the discussion about their papers, the issues, and the artwork. This experience reinforced how the lines between social commentary, age, nation of origin, art, technology, and collaborative problem solving continue to blur together.

"I could tell that when these students left my classroom, this was probably one of the best [art class] experiences they had ever had," Bowie said. "The students made a real connection with Camilla through the Skype interview, face to face. And it really helped clarify in their minds the important role of technology and art from a global sense, in examining social situations and solutions to bigger problems."

## STEAM IN THE "REAL WORLD"

So what happens after a liberal arts student successfully completes high school, has an engaging college experience, and is preparing to enter the "real world"? Rios said that in today's job market, the most highly sought

after employees are those who are masters of interdisciplinary skills and that in her experience, these candidates tend to come from a liberal arts background, well-versed in history, art, design or philosophy. "They're the ones being pursued by the technology firms. Their critical thinking abilities and their abilities to contextualize information is what makes them stand out," she said.

Former information technology industry recruiter, Ian Kanski, couldn't agree more. "During my days of building pipelines of highly specialized candidates in the IT industry, I kept coming across highly successful consultants with degrees in the fine arts, English, and philosophy. It was interesting to me to see that the conceptual processes of problem solving gave them an edge in technology industry careers."

Kanski, a fine arts major, himself, explains why: "A student studying art, language, and humanities becomes wired with exploring parallels and metaphors — relationships between things that aren't easily recognized as parallels. Students of philosophy know how to examine the broad strokes and bigger concepts. English and creative writing students understand metaphors and multiple ways to describe the same ideas. Visual artists deal with relationships and how different elements relate to each other. All of these students are trained to notice very specific things while at the same time, maintain the ability to "zoom" in and out of the problem to understand the broader mechanics of what is happening."

"Being able to recognize a pattern, get an idea of what is happening, and then be able to apply this method of understanding to a similar problem is the key," he said. This is the best way to address complex problems as the world demands hybrid solutions to new issues. Professionals with a deeper understanding of art and design, alongside the technical disciplines, are the ones capable of finding these solutions.

No one can begin to imagine what the world will be like 10 years from now, but our society should remember that while history's greatest minds — innovators and problem solvers such as Leonardo Da Vinci, Nikola Tesla, and Albert Einstein — were enabled by their STEM studies, they were inspired and guided by the humanities. The Academy's robust liberal arts curriculum provides a balanced, interdisciplinary education and is producing students and graduates who are confident, successful problem solvers in the 21<sup>st</sup> century world. And as knowledge, tools, and resources continue to expand at Harrisburg Academy, the success of its students will only follow suit.

