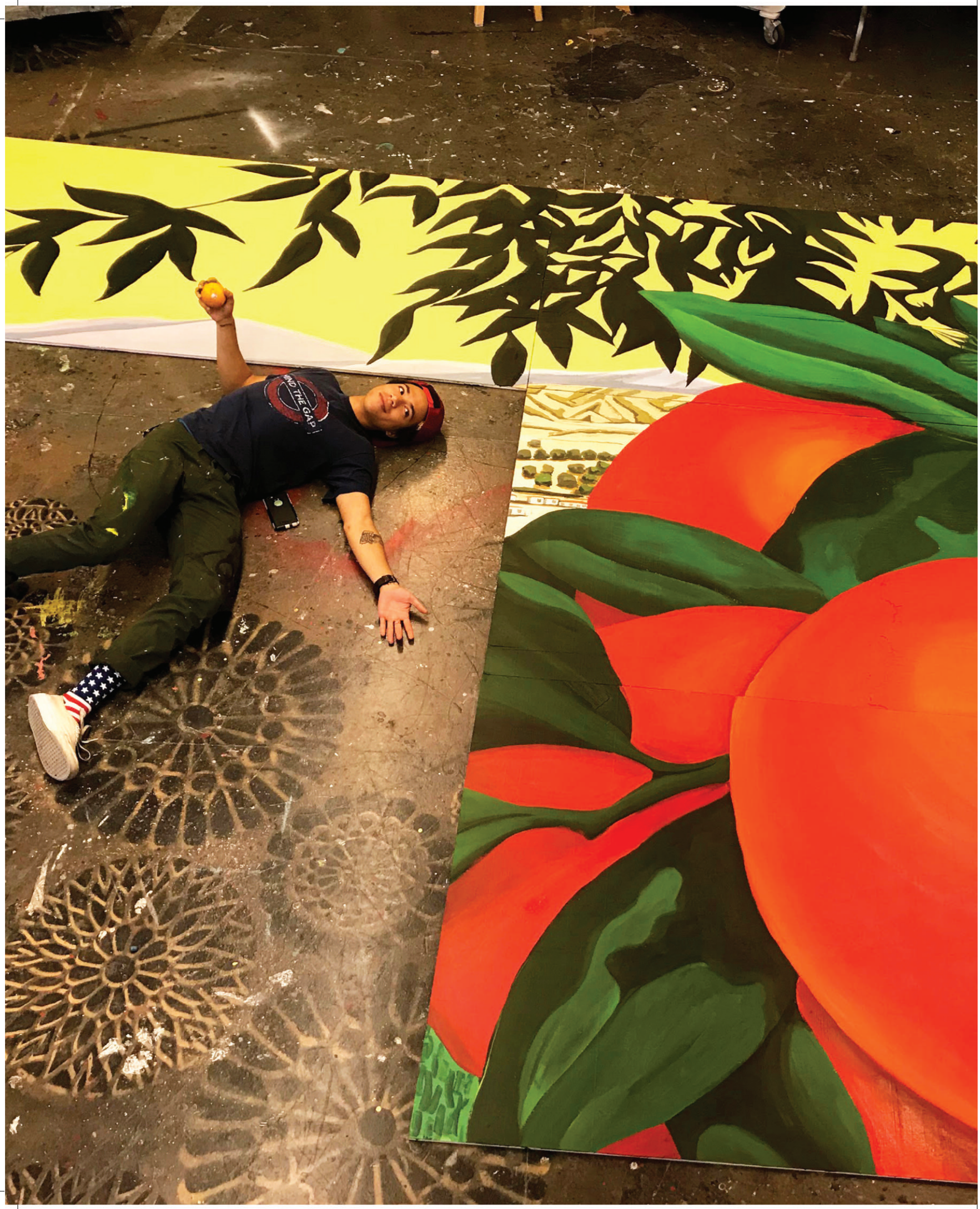
Friction
Jamie

FINI
MATHEMATICS ANONYMOUS

Desire
PEAK
EXPANSION
CONFLICT
Rise
Fall
THE RISE AND FALL OF POPULATION
PEAK
DEPRESSION
Apocalypto
The Students


GAP

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CHANGING THE SUBJECT

TWENTY YEARS OF PROJECTS FROM HIGH TECH HIGH

JEAN KLUVER • JEFF ROBIN

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GREAT
ROOM

INTRODUCTION

In the fall of 2019, Larry Rosenstock learned he was a finalist for the WISE Prize in Education. When asked what he would do with the prize money if he won, he replied, "I'd like to share the work of High Tech High students and teachers with the world." And so the project of this book and its accompanying website began.

A few years before, Larry and Rob Riordan were asked, "What should students know in the 21st century?" Their response, never published, but passed from e-mail to e-mail by many teachers, was a two-page article entitled, "Changing the Subject." Their answer, in brief, was that in this age of ubiquitous and accessible information, it matters less what students know than what they can do. "When we learn—really learn—we transform the content, the self, and the social relations of teaching and learning," they wrote. "This is what it means to change the subject."

Larry and Rob's short paper harkens back to what John Dewey said in 1916:

> "There is no such thing as genuine knowledge and fruitful understanding except as the offspring of doing…[People] have to do something to the things that they wish to find out about; they have to alter conditions. This is the lesson of the laboratory method, and this is the lesson which all education has to learn." *(Democracy and Education, page 340)*

Of the thousands of projects High Tech High teachers and students have undertaken since the first school opened in 2000, the fifty documented in this book are a mere sampling; we hope they provide inspiration and a starting place for many more creative iterations. We curated them by asking current and former teachers (now numbering in the hundreds) to nominate work that was both inspiring and replicable.

As we studied the many project submissions and interviewed the teachers who created them, patterns began to emerge. The best projects make change—they change the world, change the community, change the teacher and the learner. We thought of one of Larry's other favorite quotes, from Paulo Freire:

> "Knowledge emerges only through invention and reinvention, through the relentless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other." *(Pedagogy of the Oppressed, page 53)*

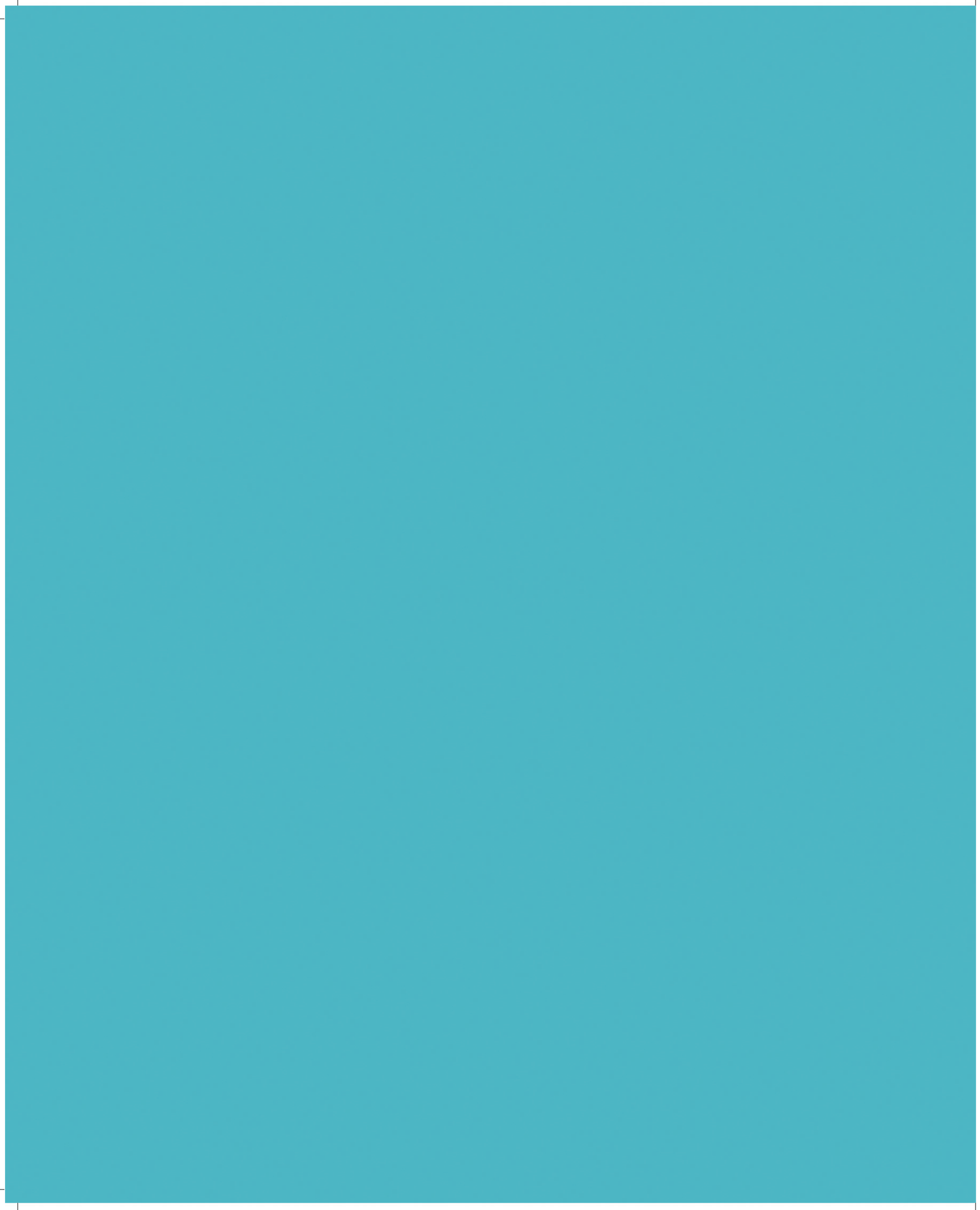
We realized the best way to categorize these projects was not by grade level or subject matter, because indeed, most of them combine multiple disciplines and could be adapted to any grade level. They can best be organized by the way students use their learning to make change. Thus our chapters are inspired by Freire,

Invention and Reinvention: in these projects, students and teachers are creating something new in the physical world.

In the World, With the World: in these projects, students are understanding the need for change in their world and making that change, through service or community action.

With Each Other: this category could rightly fit any project, since they all transform the learner and the teacher, but some are most focused on examining beliefs and relationships and changing them.

Our purpose in this book is to share highlights from High Tech High's first twenty years. In doing so, we aim to describe, not prescribe. As Larry often says, "This isn't how to do it, it's how we did it." To share more images of student work and students at work, we only briefly describe each project. But for many of these projects, teachers have also made available a wealth of background material: reading lists, writing prompts, rubrics, critique sheets, graphic organizers, assignments, calendars, assessments, crosswalks to Common Core standards, and more. For those materials, visit www.changingthesubject.org.



INVENTION AND REINVENTION

In these projects, students and teachers are creating something new in the physical world.

LAKEVIEW

THE BLOOD BANK PROJECT

TOY STORY

BUBBLES IN SPACE

COMPLEXCITY

ABLEGAMERZ

SPACESHIP EARTH

STAIRCASE TO NOWHERE

THE ARCADE PROJECT

ROTATIONAL VOLUMES

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ECONOMICS ILLUSTRATED

COME PLAY WITH US

KINETIC COASTERS

A FIGHT WITH GRAVITY

RAPTORS FOR RODENTS

PLANTING COMMUNITY

THE CHOCOLATE PROJECT

Kinetic

artist Rubin Margolin, who makes wave generating machines, had always fascinated Phillip Estrada and Mele Sato. In between other projects, Phil spent two years teaching himself to make gears similar to those in Margolin's sculptures. "I needed time to experience how to make these machines. I needed gears, resources to make prototypes, and exemplars," he said.

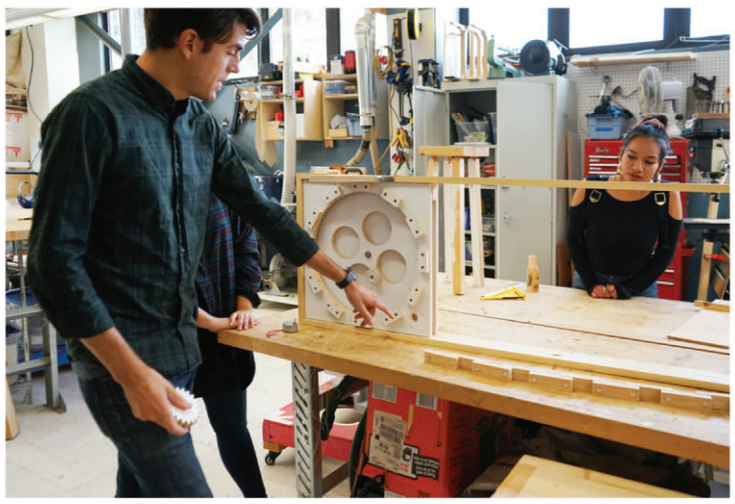
After making prototypes and exemplars, Phil realized how much he learned from the process of constructing, modifying, redesigning, and creating a new version. He planned for students to go on a similar supported path that culminated in a machine of their own design to translate a circular motion into a wave form.

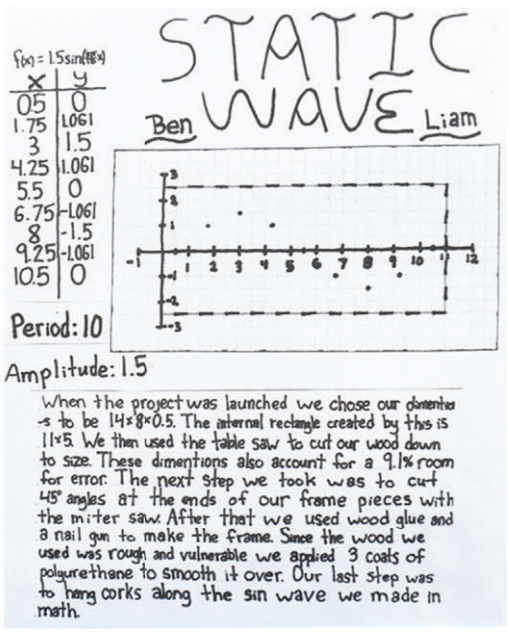
Students first made a frame and defined a formula for a sine wave to fit that frame. They had to be accurate in manipulating the variables of the frame and wave so that the physical product would match their graphs.

Students copied Phil's exemplar wave machine. They drew detailed pictures and plans based on this model, and then cut out all the parts and assembled it. Once they made a model, students documented what they learned and made plans for their next version.

All student groups modified their original model to make it more interesting to them. They used Richard Serra's verb list, a list of action words that he used in his sculptural practice, and Margolin's website as inspiration. Their plans received critique from both teachers and peers. These modified prototypes were not required to be beautiful work.

For the final portion of the project, groups refined their designs through critique and revision. There were checkpoints throughout this phase to help everyone stay on track.





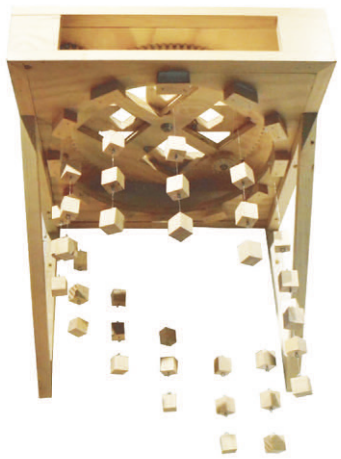
L A K E V I E W

ANAGRAM FOR "WAVE LIKE"

TWELFTH GRADE • ENGINEERING • MATH

P H I L I P E S T R A D A • M E L E S A T O

HIGH TECH HIGH MEDIA ARTS



LEARNING GOALS

- To have a deep understanding of gear ratios
- To value the prototyping process and develop it for future projects
- To understand how revolutions per minute (RPMs) are translated into frequency
- To learn how to use algebraic functions when working with real materials

SCAFFOLDING AND DIFFERENTIATION

The first assignment, Static Wave, was designed so that students could learn to use tools, test their quality of work, see math integration, and experience success. The students could start with a simple project to build towards greater design and mathematical difficulty.

The second mini-project, copying the teacher's prototype, enabled some students to make a model and not feel the immediate need to create something new out of whole cloth.

Students looked at Rubin Margolin's work, drew pictures of their favorite sculptures, and created their take on how a circular motion could be transmitted to a wave form.

Three to four students latched on to an idea and formed groups. Then they came together with their copies, pulled them apart, and then built a prototype of their new ideas. These new ideas were then certified as "ready to build" if they ran for 20 minutes. New wood was purchased, and the final version was made.

REBELLION PROJECTS

Some students had less interest in the engineering and building aspects of the project and wanted to be able to create their own way to contribute. There were three rebellion projects:

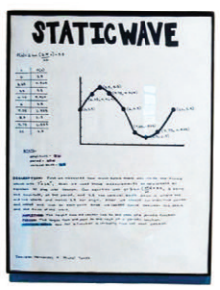
Photo Journal. One group of students documented the whole process.

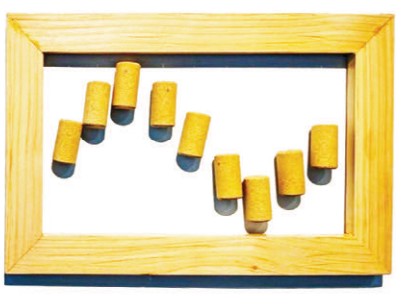
Exhibition Curation. Curation is a significant skill in itself, often controlled by the teacher. In this case, a group of students wanted to take it on as their final project.

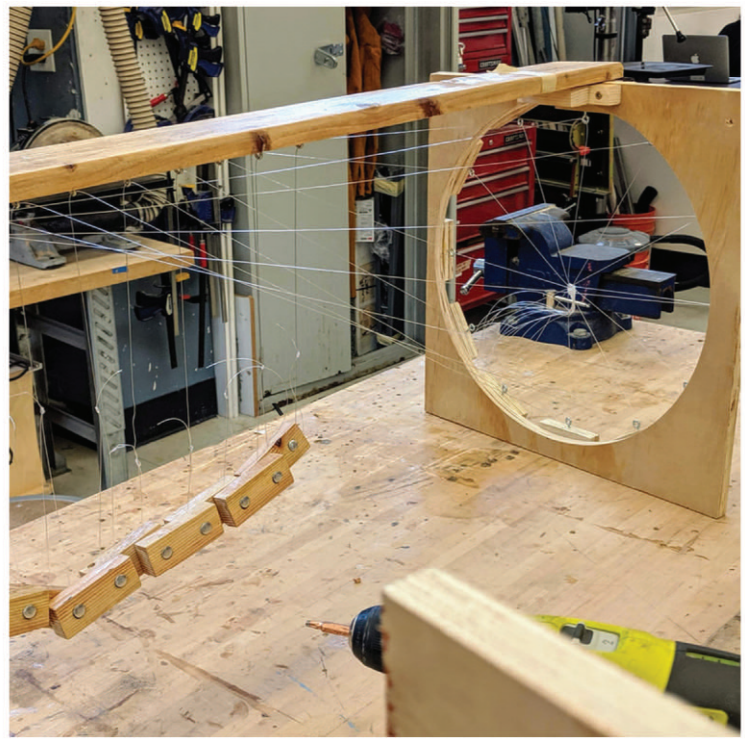
Environmental Audit. Environmental impact, including the use and disposal of materials, is a real issue in project-based learning, and one group decided to take this subject on, including a display of impact analysis in the final exhibition.

EXHIBITION

The students' work was displayed in a permanent installation in the school. Its accessibility and interactivity made it an extremely popular attraction. Viewers can engage with the work by just viewing, turning the machine on and off, or exploring the math behind the inventions.







At a "Moving Paintings"

exhibit at the San Diego Museum of Art, Jeff Robin, Blair Hatch, and their students saw the animated paintings of William Kentridge. They wanted to make paintings and move them in multimedia with their students.

Since Jeff volunteered at the San Diego Blood Bank and Blair had a background in physiology and biology, together they came up with a bio-physiology-multimedia-painting project. Students worked in groups to research and define an aspect of blood physiology, blood banking, or blood-related diseases. They made paintings explaining these ideas, and then animated their stories. The students then made kiosks with old laptops inserted in them to play the animations. The kiosks were hand painted and cut out of wood, much like Kentridge's work.

HEMOPHILIA ANIMATIONS:
- What Is Hemophilia?
- History
- Causes

BLOOD LETTING ANIMATIONS:
- History of Blood Letting
- Washington's Death
- Blood Letting Today

BLOOD TRANSFUSIONS ANIMATIONS:
- When Do You Need a Transfusion?
- Plasma
- Blood Types

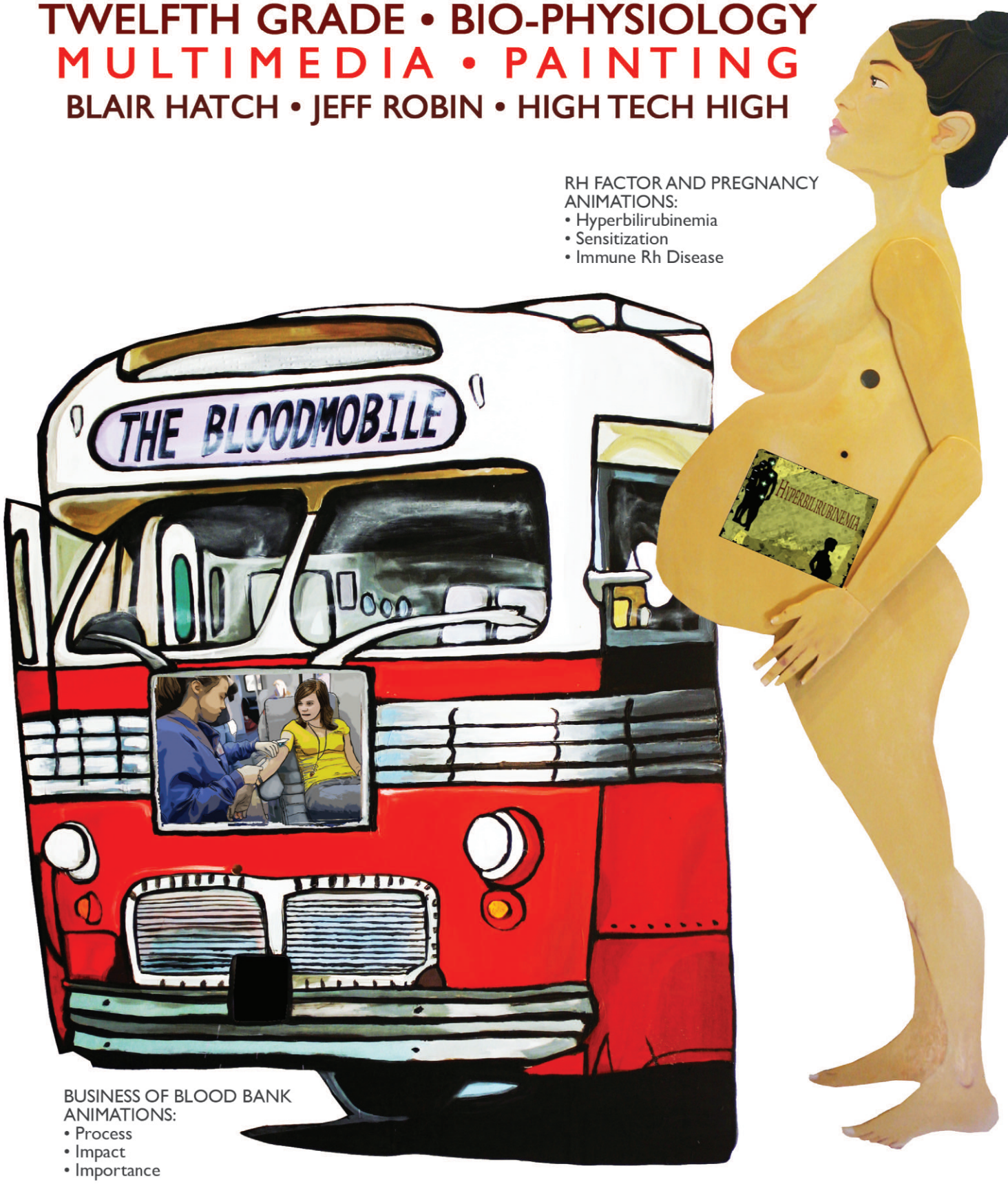
THE BLOOD BANK PROJECT

TWELFTH GRADE • BIO-PHYSIOLOGY

MULTIMEDIA • PAINTING

BLAIR HATCH • JEFF ROBIN • HIGH TECH HIGH

RH FACTOR AND PREGNANCY ANIMATIONS:
- Hyperbilirubinemia
- Sensitization
- Immune Rh Disease



BUSINESS OF BLOOD BANK ANIMATIONS:
- Process
- Impact
- Importance

Inbio-physiology, the students studied blood and the process of oxygenation, as well as blood diseases and the history of blood banks. The San Diego Blood Bank arranged to have doctors, blood donors, hospital administrators, county public safety officers, and phlebotomists come and speak to the students three times a week for the first four weeks of the semester. These specialists became mentors for the students and helped them accurately tell a story about blood physiology.

In art class, students learned to illustrate a visual story about blood by doing artwork. They learned techniques using digital tools to enhance their drawing ability. All students learned to draw using these techniques, enabled by Photoshop and critique. They learned how artists like Christo, Kahlo, Hausman, Bochner, Steinburg, and Gauguin used images and writing in their artwork.

In teams of two, students picked a minimalist sculpture and made a poster explaining it. The students utilized their new drawing, Photoshop, and SketchUp skills, and an understanding of how visuals and text have been mixed in the past. This served as a practice or mini-project to prepare for a poster about their blood topic.

Coming together with a technical and illustrative story from the physiology class, each team created a poster to explain their subject as it relates to blood and/or blood banking. Students painted these posters, using Photoshop and scanners, colored pencils, Google SketchUp, or a combination of all these mediums.

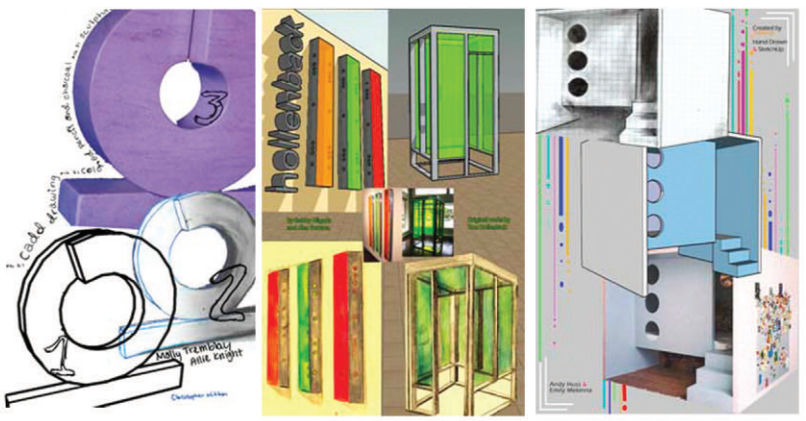
The images they created for their posters were starting points for the images they would use later to make their animated movies using Adobe After Effects. These topics ranged widely, and included hemophilia, mobile blood banks, heart attacks, strokes, Rh factor in pregnant women, leukemia, blood thinners, HIV/AIDS, bloodletting, blood transfusions, blood in film, and sickle cell anemia. Students had to create three to four animations covering various aspects of their story, which included composing music, writing scripts, and narrating the movie.

Using retired laptops (no longer in use by the school), the students loaded up their blood explanations and stories, inserting the laptops into their hand-cut and painted kiosks that helped tell the story of their subject.

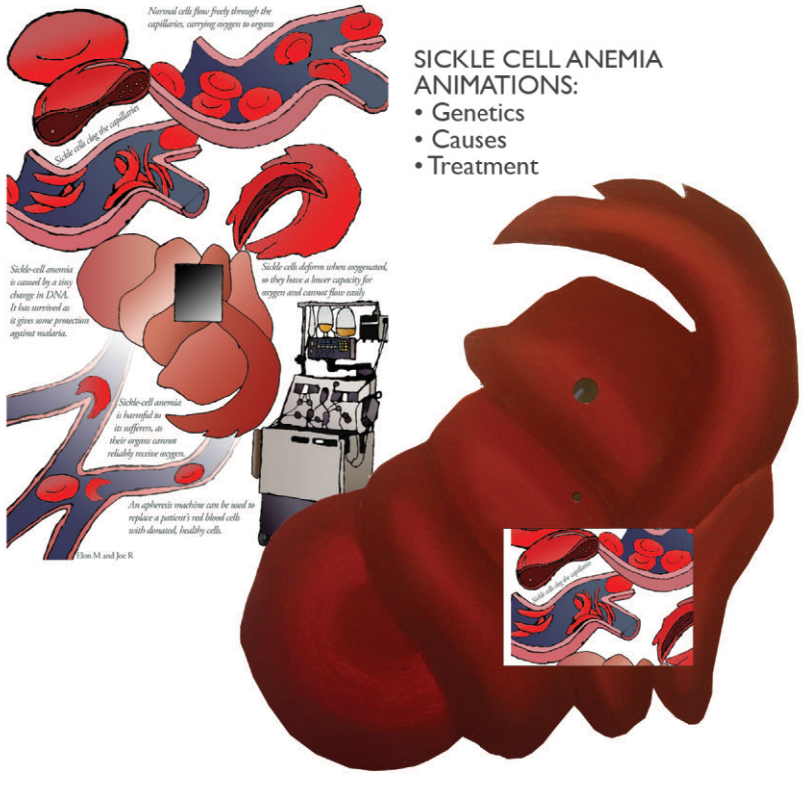
LEARNING GOALS

- To learn the biology and physiology of blood
- To gain exposure to a range of professionals and experts in the field
- To develop research skills
- To find an interesting story about blood and present it in a captivating way
- To develop drawing, painting, woodworking, and photoshop skills
- To learn After Effects and animation skills

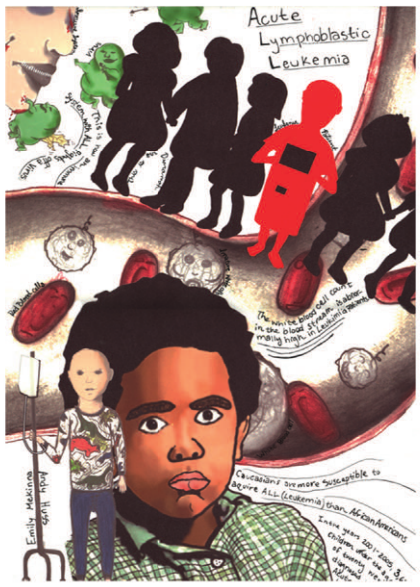
President of San Diego Blood Bank



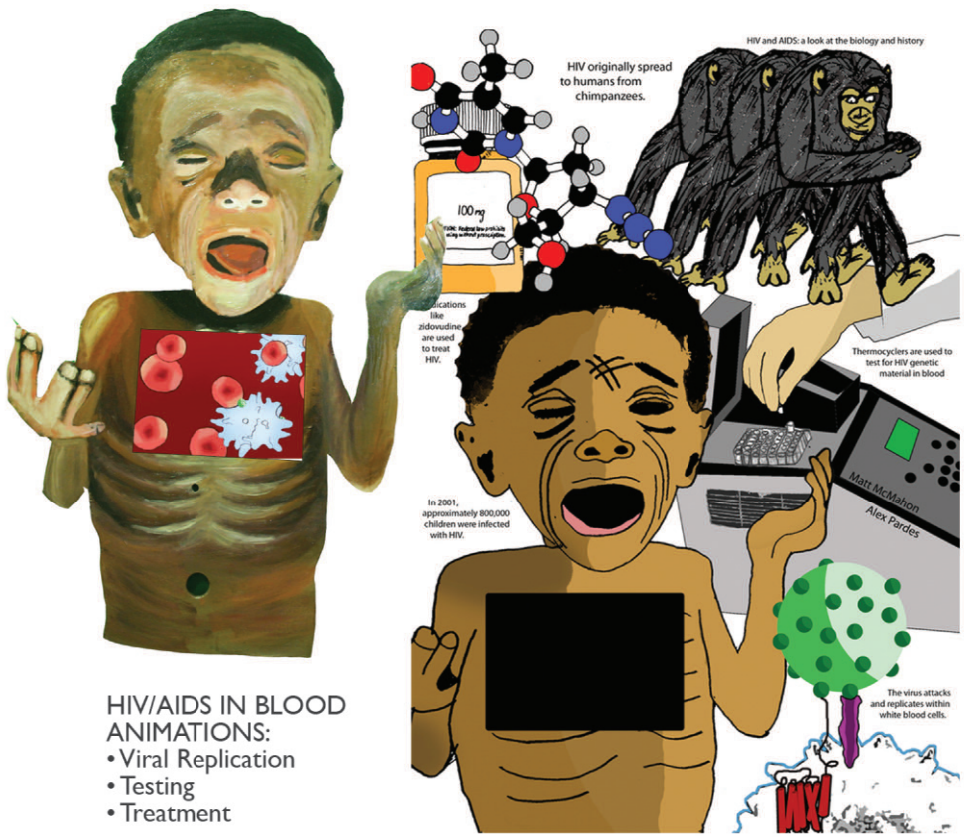
Mini-project: Minimalist sculpture posters with words



SICKLE CELL ANEMIA ANIMATIONS:
- Genetics
- Causes
- Treatment



ACUTE LYMPHOBLASTIC LEUKEMIA ANIMATIONS:
- The Immune System
- White Blood Cells
- Diagnosis



HIV/AIDS IN BLOOD ANIMATIONS:
- Viral Replication
- Testing
- Treatment

ASSESSMENT

Students had weekly check-ins with both teachers. These check-ins required them to be up to date on progress in multiple mediums. This was a struggle for some, as doing work was fun, and finishing to a high level was the real work. Students had opportunities to do scaffolded assignments, activities that were all connected to the final exhibition of their work.

DIFFERENTIATION

Choice was the major form of differentiation in this project. The students were able to choose their subject areas and relate it to blood physiology, if they could make a case for it. One group was fascinated with the AIDS virus and made an animation that showed how HIV replicated in the blood and destroyed white blood cells. Another group evaluated the use of blood in films, how it was portrayed, and whether it was realistic or a fantasy.

Eighty percent of the students exhibited their work at the Jet Gallery in San Diego. This was a working gallery, not a public exhibition space. The gallery owner had control of the exhibition; the students learned how much hard work is required to create finished pieces worthy of exhibition in a gallery.

What is the magic of toys?

The enduring magic of toys, as well as what we might imagine their magical lives to be, formed the inspiration for the Toy Story project.

Janna Anderson, Ruby Rodrigues, and Jami Saville knew that all second graders love to play and imagine; they also wanted their students to learn the elements of a story. They thought an authentic way to combine these two ideas would be for students to create their own toy and imagine what that toy does when no one is around. To make the project more meaningful, they partnered with a local preschool so that the second graders could work with the younger students to design a toy and a story with their particular buddy in mind.

PROJECT LAUNCH

On the project's first day, the children arrived in their classrooms to see that a mysterious mess had been made. They were challenged to imagine what roles the stuffed animals and various toys in the classroom might have played in the wreckage and why. As they shared their imagined stories, the teachers revealed the details of the project.

TOY STORY

JANNA ANDERSON • RUBY RODRIGUES • JAMI SAVILLE
SECOND GRADE
HIGH TECH ELEMENTARY CHULA VISTA

LEARNING GOALS

- To build relationships and empathy with younger students
- To collect and analyze survey data
- To display data in various formats
- To understand the design process, including research, planning, prototyping, feedback, final production
- To develop fiction writing, critique, and revision skills

Second graders visited with their preschool buddies multiple times during the course of the project. First they played games and read aloud to get to know each other; then they surveyed their "clients" about the kinds of toys and stories they liked. Back at school they collected their data and created graphs. They organized the types of toys into three groups—stuffed animals, toys on wheels, and block puzzles. Students selected the kind of toy their buddy would most like to have.

Meanwhile, teachers shared and mapped many stories with the students to help them understand story elements and characters. Then the students brainstormed and wrote their own stories that featured their preschool buddy as a main character, and the toy they were making as a part of the story. Through many rounds of critique and revision, they wrote and illustrated a board book especially for their buddy.

ASSESSMENT AND EXHIBITION

Throughout the project, students and teachers co-created rubrics to help them assess how well they were doing on a number of fronts:

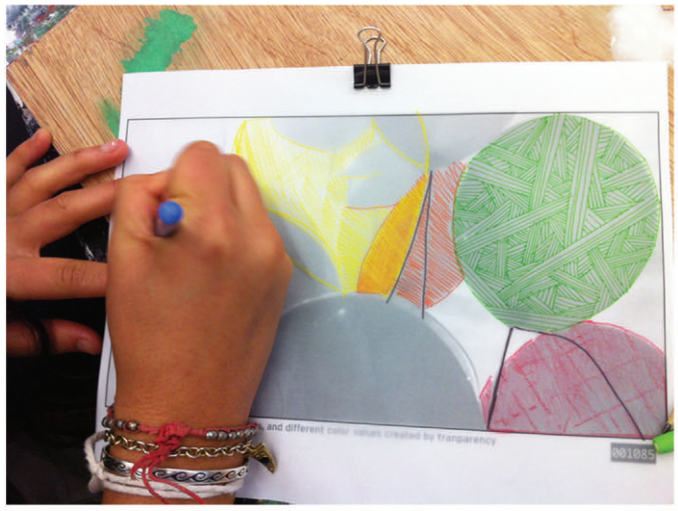
- Learning and developing empathy—how well were they understanding their buddy and their interests and desires?
- Academic content—what was the quality of their writing, and their data analysis?
- Contribution and effort—how hard were they working?
- Critical thinking—how were they asking thoughtful questions, making connections, and synthesizing new learning?
- Toy design process—how well were they planning, creating prototypes, integrating new ideas, and learning from prototypes?

The final toys and books, along with the project's process, were exhibited to parents and the school community. Shortly thereafter, the students celebrated with their preschool buddies and presented them with their toys and books.

Art teacher

Jeremy Farson and fifty high school juniors collaborated with musician Mike Andrews (Elgin Park) and director Josh Hassin to create a video for the song, "Bubbles In Space" on Mike's album, *Spilling a Rainbow*.

The concept was to take live video, break it into stills, then students would trace each one, embellish it, and these drawings would be used to make a collaborative animated video. There was no way that one person could illustrate all these slides; the fifty or so hands and minds came together to trace and draw over 3,000 images in total. Jeremy gave the students creative freedom to embellish as they desired, trusting that within set guidelines their work would look cohesive and professional, and also whimsical and personal.



LEARNING GOALS

- To create a professional animated music video
- To use drawing skills and combine artistic sensibilities into a collective aesthetic statement
- To use critique to improve work
- To collaborate and see the group project as meaningful and authentic

A video was shot of Mike playing and singing, other shots were compiled from dolphins in the ocean, children playing in parks, 3D animated objects in space, and a variety of other non-sequiturs. These images were put to music, and the students watched this video to understand the concept and context of their project. Three thousands stills were printed and supplied to the students who traced, drew, embellished with personal touches, and critiqued each other's work. The students needed to communicate and collaborate closely so that the animation would flow in a smooth and professional way.

As the project went on, students came up with new ideas based on the work they saw their classmates producing. This process of sharing and critique helped to foster a more creative spirit and an imperative to push new approaches.

EXHIBITION

The video and process were exhibited at an evening event at the school. The true exhibition was the public release of the video, along with the album, described in the press release as "a fun-filled voyage through the mind of a teenager." As one student put it, this is "something that goes out beyond us. It's not just for an exhibition for school; it's for the world to see! It's not something that any other school would have done." (Eliza, 17)

The video, as well as a "Making of…" video created by one of the students, can be viewed on Jeremy's website:

https://jfarson.weebly.com/past-project-gallery.html

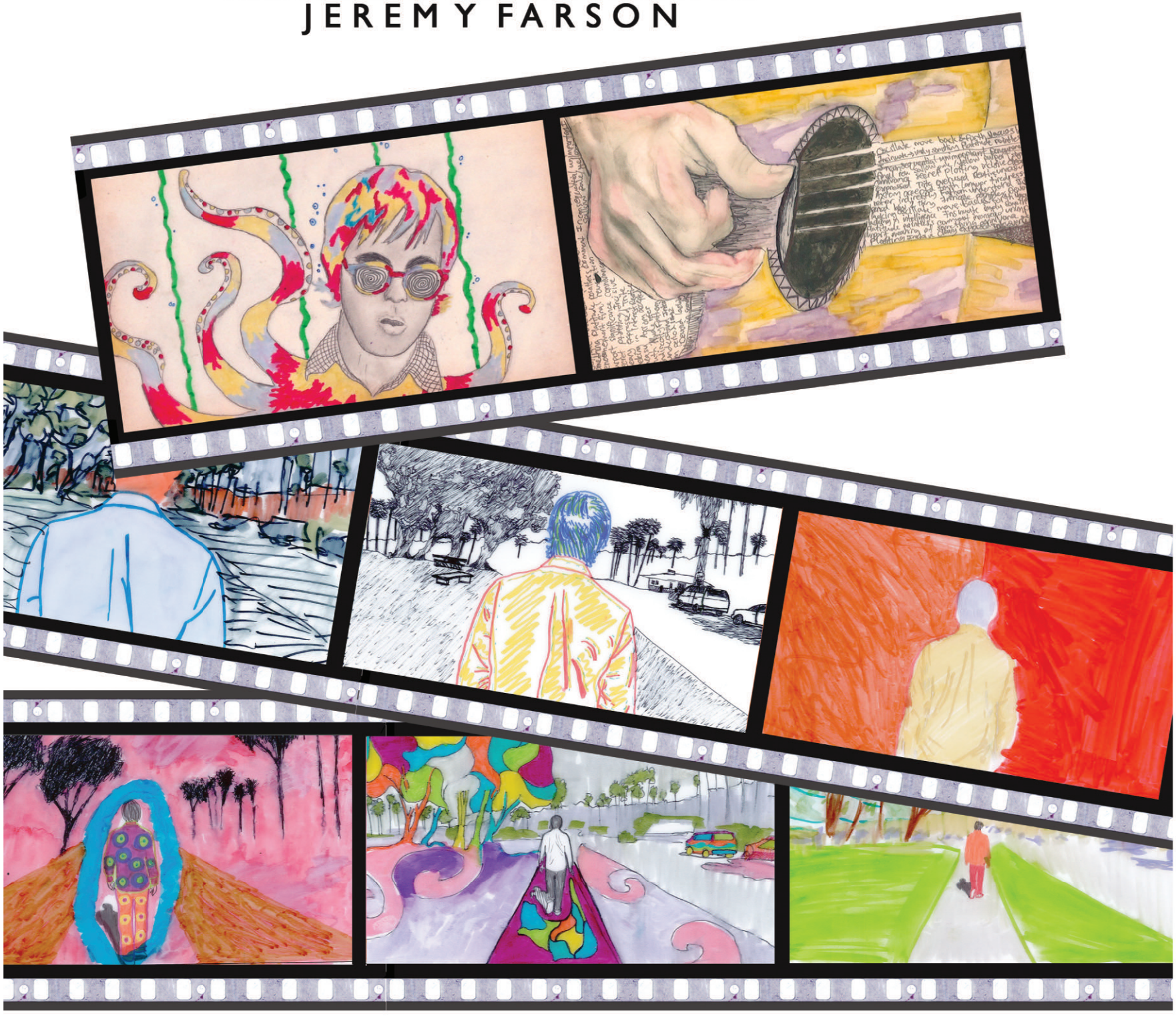
BUBBLES IN SPACE

A HAND-DRAWN MUSIC VIDEO

ELEVENTH GRADE • ART

HIGH TECH HIGH INTERNATIONAL

JEREMY FARSON



Inspired by

Rebecca Solnit's book of conceptual maps, Margaret Noble and Rachel Nichols devised an experiential project to stimulate students to think critically about their communities. Students created their own conceptual maps of the city to communicate a message they cared about.

In this project, students researched, interviewed, and investigated their city and community in myriad ways. By compiling their work and making idiosyncratic maps of San Diego, they were challenged to rethink what they understood to be the reality of the built environment around them, as well as to accept the new knowledge that their classmates contributed. Using Solnit's *Infinite City* as one model, and their own creative explorations as another, they made a series of maps of San Diego highlighting contrasts or injustices in the city.

The teachers launched the project with a challenge to map their school, with "significant moments" they had experienced in its various locations. The resulting maps and keys highlighted everything from the touching to the ridiculous: "Where I fell in love," "Where I puked," "Where my favorite teacher's room is." When layered upon each other in transparencies, the students surprised themselves with their portrait of the school.

While Margaret was teaching the students design skills, in Rachel's class, they were reading texts on cities and the built environment, including Jane Jacobs, Rebecca Solnit, and Natalia Molina. Students chose an issue that they were passionate about to research and represent in a conceptual map. Field work at the Historical Society and visits from local experts complemented their research. The resulting maps, which told stories such as the locations of banks vs. check cashing stores, bike paths vs. bicycling deaths, public places allowing skateboarding vs. those allowing dogs, were ultimately compiled in a self-published book.

LEARNING GOALS

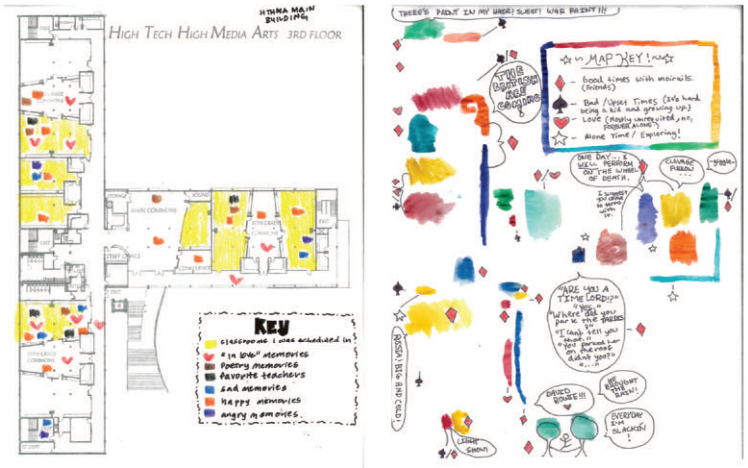
- To think deeply about issues that matter to them in their city
- To research and write a paper about something they care about in the city
- To translate a complex issue into visual art

SCAFFOLDING AND DIFFERENTIATION

The element of choice was the center of this project. Students researched and represented an issue or topic they cared about. The teachers chose the launch exercise as a map of school instead of home specifically because they knew that one of their students was homeless at the time. Readings were broken down into short sections and teachers supported those who needed it.

ASSESSMENT

Students wrote a research paper on their chosen topic. Students had to create a proposal for their conceptual map. Multiple critiques focused on whether the maps were in fact communicating the students' arguments effectively.



COMPLEXCITY

MARGARET NOBLE • RACHEL NICHOLS

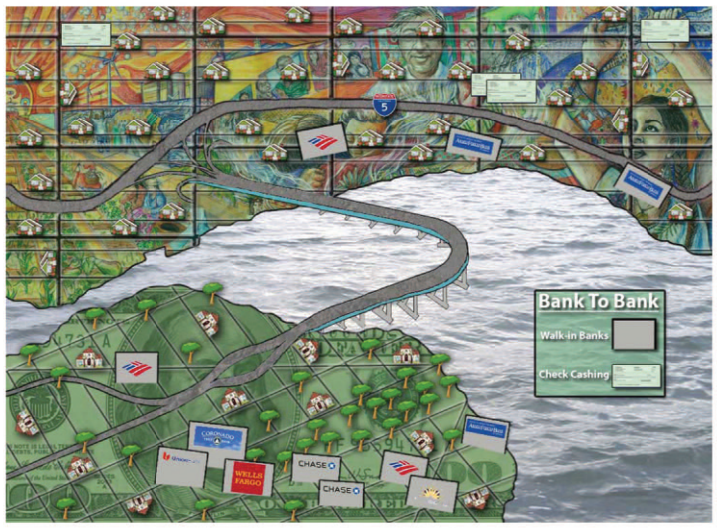
TWELFTH GRADE

HUMANITIES • VISUAL ARTS

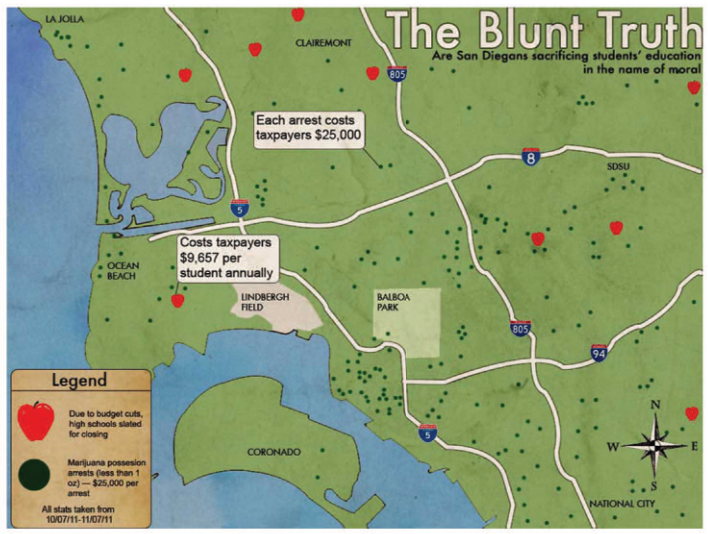
HIGH TECH HIGH MEDIA ARTS

"A city is a particular kind of place, perhaps best described as many worlds in one place; it compounds many versions without quite reconciling them, though some cross over to live in multiple worlds... An atlas is a collection of versions of a place, a compendium of perspectives, snatching out of the infinite ether of potential versions a few that will be made concrete and visible."

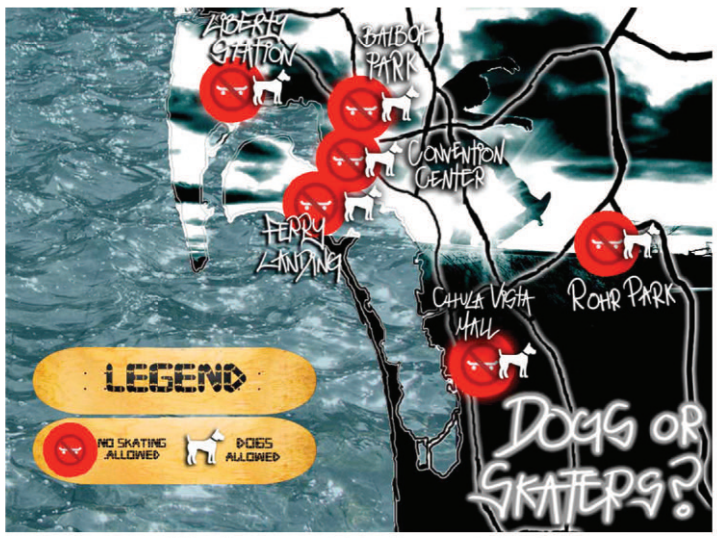
Rebecca Solnit, *Infinite City*



Check cashing vs. banks



School closures vs. marijuana arrests



Who has more rights, dogs or skaters?

Maps projected on the building of HTHMA

EXHIBITION

In an evening exhibition, the maps were projected in a looping slideshow on the sides of various school buildings. Inside the school, individual maps and essays were displayed. After the semester ended, students continued to work on the project, publishing a book of the maps.

What does ‘disabled’ mean,

and how does it affect one’s perceived value in society? How, if at all, can technology create more access to economic and social opportunities?

Corey Clark and Curtis Taylor set out to explore these questions with their sixth graders, using video gaming as both a point of common interest and a real-world engineering and technological challenge.

PROJECT LAUNCH

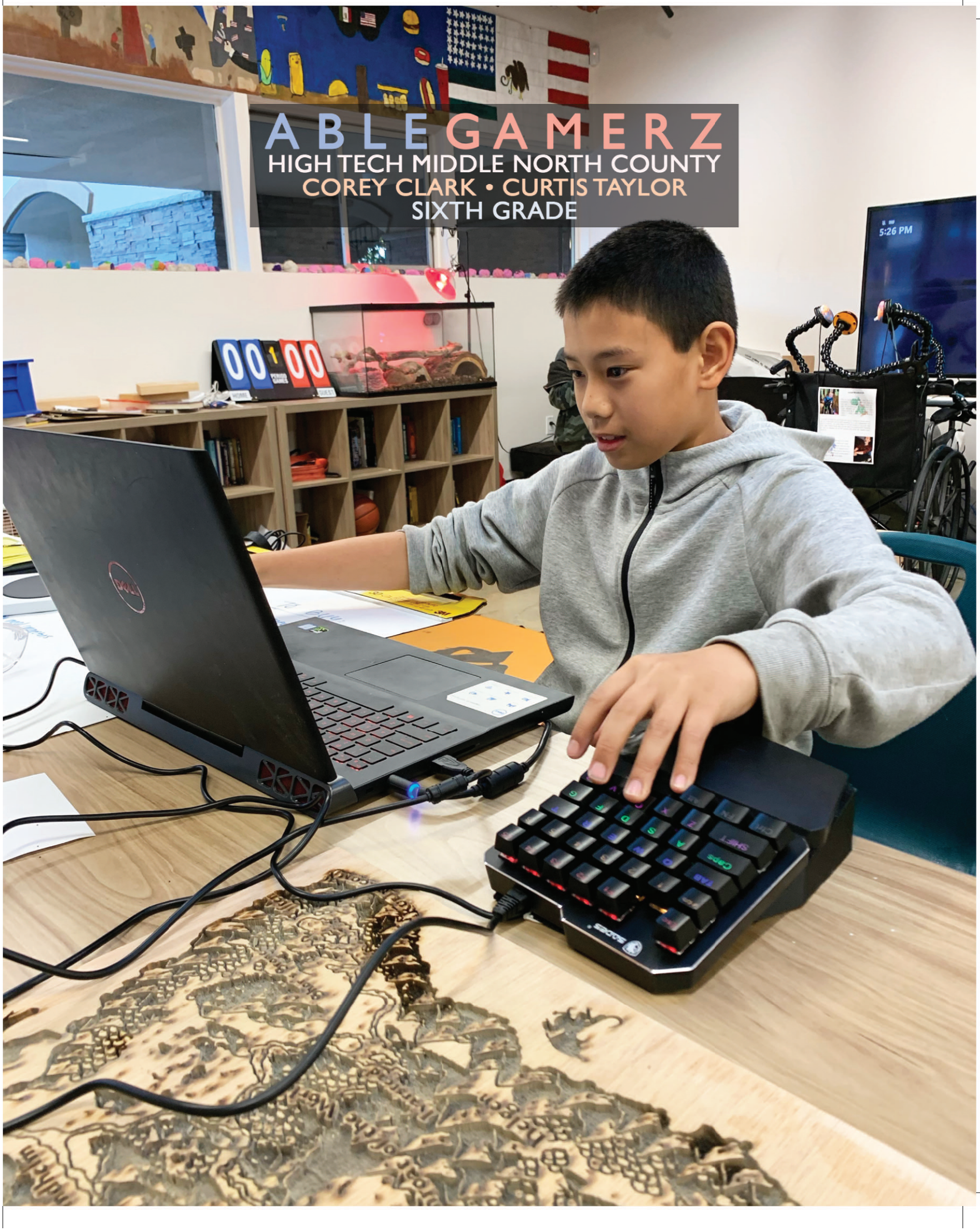
The first half of the launch day took place at school, where students were introduced to the AbleGamers organization, and went through several simulations to build empathy: being challenged to do certain tasks without the use of arms, or reading all directions through a mirror. They opened and examined some adaptive gaming controllers, reflecting on both the packaging and the adaptations. In the afternoon, the group visited a local arcade and interviewed the owner about his love of gaming and his thoughts about accessibility. Students spent the afternoon playing at the arcade, while also thinking about the accessibility issues the morning’s activities had raised.

Through collaborations with community organizations working with disabled people, students were able to become familiar with particular clients. They learned about their disability and their passion for gaming and online community, and engineered a prototype for modifying a traditional gaming controller or device in a fashion that allowed greater access and ease of use.

Using Xbox adaptive controllers and Arduino boards connected to gaming PCs and laptops, students engineered and built real working controller devices that will allow their clients to access and play games with their tongues, feet, arms, whatever is needed to adapt to their disability (muscular dystrophy, amputated limbs, paralysis, etc.)

LEARNING GOALS

- To develop empathy for people facing challenges of access and ability
- To understand a broad range of congenital and acquired disabilities
- To connect with people who are seemingly different through common interest
- To use the engineering design process to develop a solution for a real client
- To develop research and non-fiction reading and writing skills
- To learn to make a claim in writing and support it with evidence
- To think deeply about the history and functions of community, specifically in the current era of social media and online gaming communities



ABLE GAMERZ

HIGH TECH MIDDLE NORTH COUNTY

COREY CLARK • CURTIS TAYLOR

SIXTH GRADE

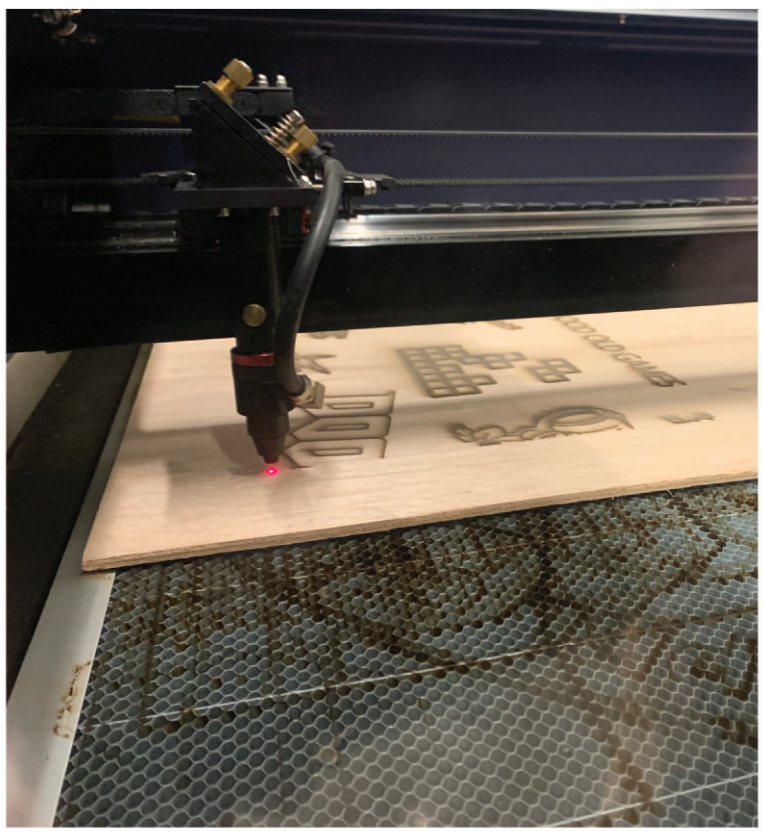
In the first iteration of the project, students studied genetic and acquired disabilities; they chose one to focus on and wrote a research paper about it. In humanities, they wrote a fictional story that featured a character who had that disability. In a second iteration of the project, the research and writing focused on some of the issues and controversies in the field of online gaming, such as girls and gaming; the impact of violence in gaming; and the representation of characters in games. They examined questions of community, including how online gaming communities are different from other communities.

SCAFFOLDING AND DIFFERENTIATION

Curtis and Corey wanted the students to be able to play to their strengths. They designed seven jobs for students to fulfill during the project, such as engineering crew, documentarian, and circuitry specialist. Students had to write a paragraph explaining why they would be good for the job they wanted, and then were "interviewed" by the teachers.

EXHIBITION

Students exhibited their work at the same arcade where they had begun the project. They exhibited their writing and research, as well as websites they had created that documented their adaptive rigs. TV screens were set up with adaptive rigs so that all participants could try them out. The final rigs were shipped to the clients and students were able to Skype with them to see how they worked.



XBOX
Wii
Skylanders

EXIT
THE GOOD

Image taken from a
student weather
balloon at 100,000
feet above the Earth

SPACESHIP EARTH

ROCKETS • WEATHER BALLOONS
ASTRO-PHOTOGRAPHY • EARTH SCIENCE

ADAM BOREK • ANDREW LERARIO • BRIAN DELGADO • MIKE STRONG

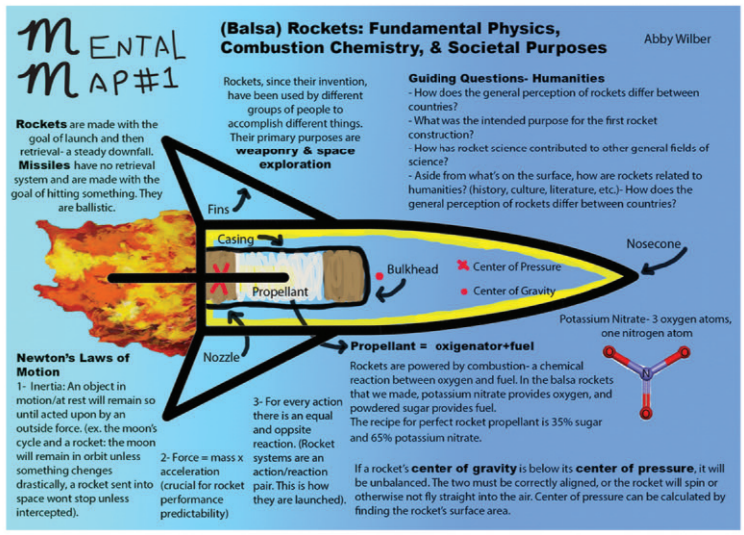
ALL GRADES • HIGH TECH HIGH

Andrew Lerario and Brian Delgado looked through a telescope with some students they had brought to the San Diego Astronomy Association. As they peered at celestial bodies, they felt an infectious enthusiasm from the students. Andrew asked, "What if we started a NASA at High Tech High?" The working question was, how can we get something off the Earth?

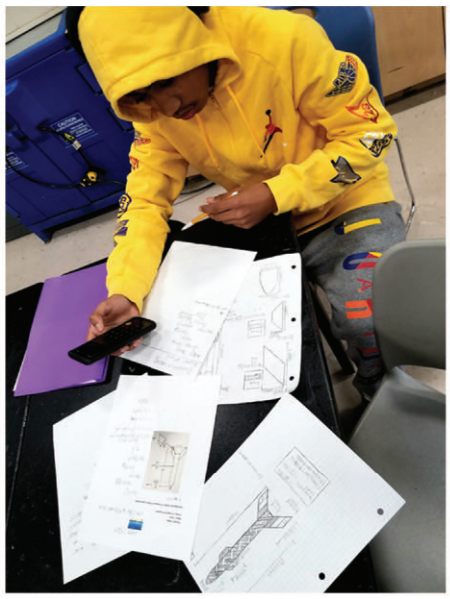
They started with weather balloons as a class project. The students' researched weather balloons, how to build, launch, and retrieve data from them. The students built a package with a camera, GPS, parachute, and instruments to measure weather conditions.

Andrew, a chemistry teacher, went home that summer and worked on building a rocket as a prototype. That fall, his class started with simple paper rockets, then Estes rockets, taking them apart to make their own motors. Theo Lundblade, a senior, wanted to make his own engine. He made a rocket-propelled airplane, and the Spaceship Earth project was born. The teachers used the seniors' experimentation to see what the freshman and sophomores in their classes could do.

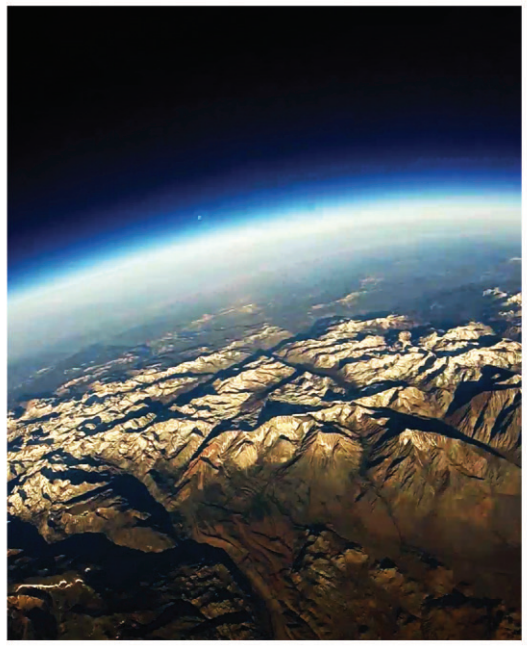
The following year all four teachers came together with their four classes to launch collaborative projects: Big Rockets, Astronomy and Astro-photography, Weather Balloons, and Environmental Science/Nature Exploration. All four classes experienced space and Earth and made films about their experiences.



Students started by building mini balsa wood rockets, using tools and making engines. They launched and revised multiple times. If the rockets went sideways, they worked on the center of mass. If they exploded in flight, they reformulated the engines; everything was an experiment. The students then moved to the medium-sized Estes rockets. They experimented with going higher and farther. Students learned through experience how Newtonian laws applied to their work.



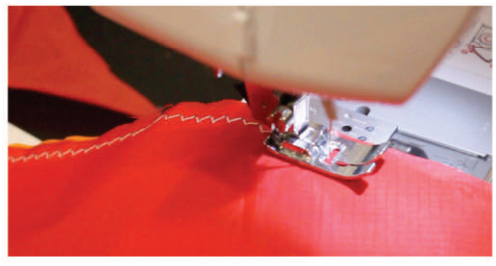
After eight weeks of rocketry, students were able to opt into Capstone activities with the following broad goals:



Weather Balloons: to launch four balloons and recover them with recorded data.

Earth Science: to go on a series of explorations on land and sea.

Astro-photography: to photograph and identify objects in the night sky.



Rockets: to make a successful and recoverable Phoenix-sized rocket.

LEARNING GOALS

- To know Newton's laws and be able to give examples of how they are applied
- To understand cosmology, how the universe was formed
- To understand atmospheric science
- To be introduced to the history of astronomy, and how the power of intelligence shapes what we know about the universe

ASSESSMENT

The students wrote weekly blog entries about their process. Individual conferences with their Capstone teacher and with the other teachers helped them see how the work was connected. Each Capstone group presented weekly to the other groups to demonstrate what they understood about the process they were experiencing. They made films of the work and evidence they collected. Teachers collaborated to create a syllabus of texts, including literature, non-fiction, and scientific articles to reinforce the students' experiential learning. Students reflected in writing and discussion about how the texts related to their learning.

SCAFFOLDING AND DIFFERENTIATION

All the students knew they would do rocketry for the first eight weeks. If they were not interested in pursuing space at the end of the rocket launches, they could move into other Capstones. Within each Capstone group, students had various roles or specializations, such as electronics, documentation, machinist, designer, and planner.

EXHIBITION

Each Capstone group collaborated to create one or more films about their experiences. The final exhibition consisted of a screening where all of the films were shown to family and friends.

“If a staircase goes somewhere, it is craft; if it goes nowhere, it’s art.”

Jeff Robin and Andrew Gloag planned to do a collaborative project. Jeff had an interest in staircases from a failed staircase he tried to build at home. Andrew knew that there was lots of physics, trigonometry, and geometry within staircase construction and design. The math was broad enough that all students, no matter their level, could use the math they knew and math that they would learn to design and document their constructions.

Jeff created the model staircase exemplars and understood the scope and difficulties of creating scale models. Jeff and Andrew worked together on the scope of the project, understanding students would learn by making scale staircases and doing the math. This knowledge led them to create open-ended learning goals that would allow for student voice and choice.

Over the summer, Andrew and Jeff planned the project, where they quickly found out that they should start small. The teachers made a 1:10 scale model as proof of concept and the first exemplar. They then created a math poster to explain the staircase they built.

STAIRCASE TO NOWHERE

TWELFTH GRADE • PHYSICS • ART

ANDREW GLOAG • JEFF ROBIN • HIGH TECH HIGH

LEARNING GOALS

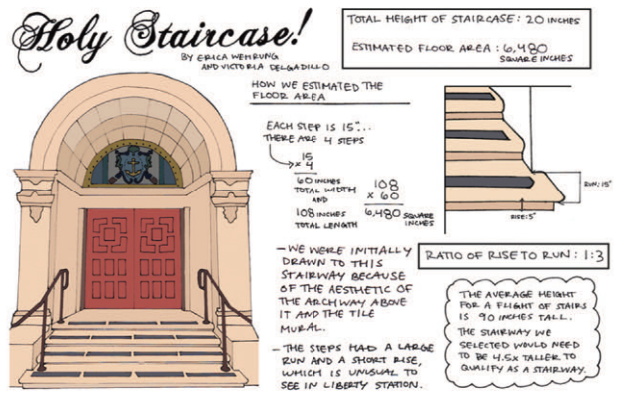
- To learn the geometry, algebra, and trigonometry required to design a staircase
- To learn (or improve skills in) CAD and SketchUp
- To explain how mathematical concepts are used in physical design and construction
- To work collaboratively in multiple teams
- To develop critique and revision skills

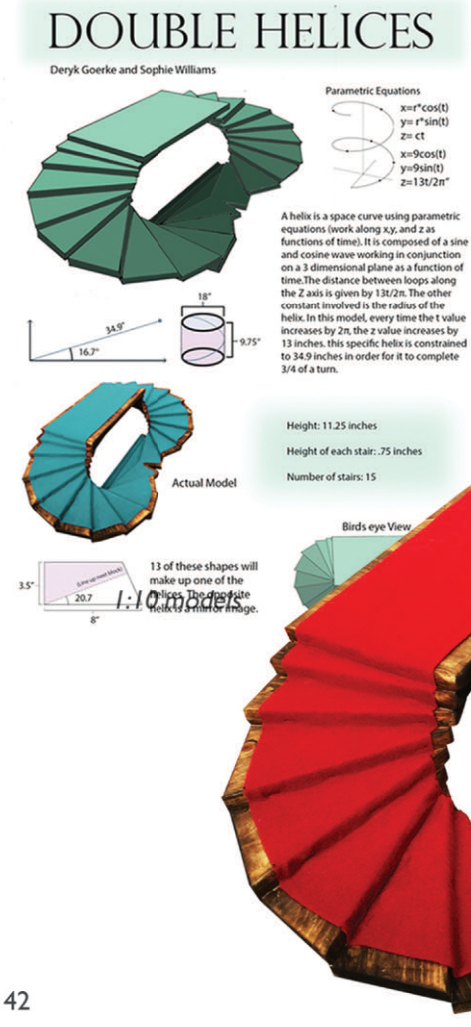
The first day of class the students arrived and were handed a yardstick. In pairs, they went out and measured real staircases. They weren't tipped off as to what the project would entail. All they were told was "go out with your partner and document a staircase."

The first assignment was to create a 1:10 scale staircase of any design they wished. Students created a poster explaining the math they had used in their staircase. The idea of this first assignment was to have fun and for students to realize that their intuitive and prior math knowledge could help them design and build. It also served to create curiosity for the math they would learn next.

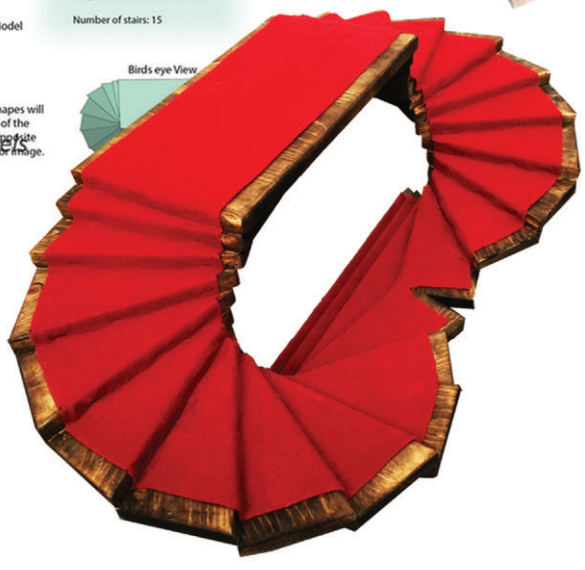
For the second assignment, teams of two designed and created a 1:5 model staircase highlighting newly learned math concepts. Most teams worked with their teachers to find a math concept that they could utilize. From parabolas to quadratic equations to fractals, each team dove deeply into a concept that they could apply to a staircase. Working in teams was essential: both students had to learn SketchUp or CAD to design the 1:5 model staircase.

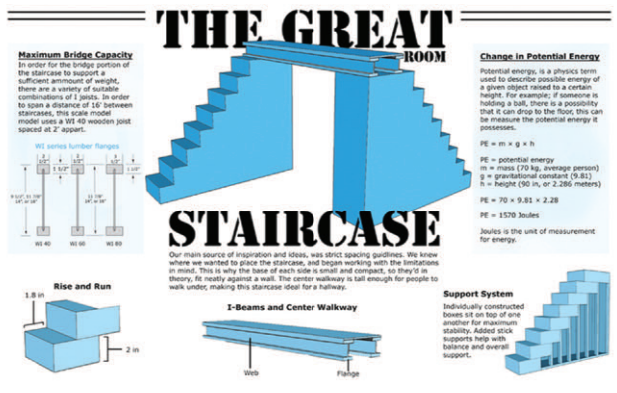
Yardstick Project



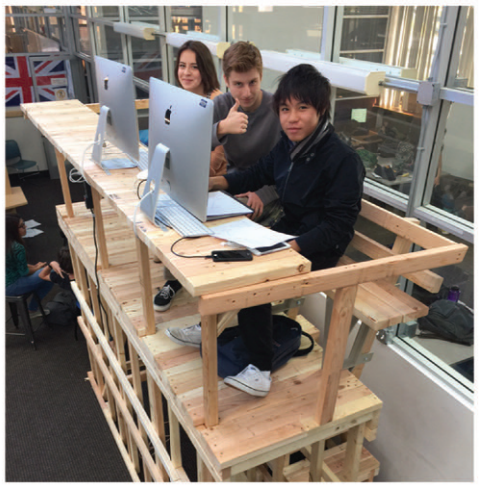


1:5 models





CALIFORNIA REP



THE ELEVATED DESK

LULU BARBA, SAM COSIO, DREW DAGLEY, ETHAN GRIZZARD, ELIZABETH HAN, ALEAH IRANI, ELIAS LEDESMA, AND ALBERTO MORENO

OUR STAIRCASE INCUDES A WORK AREA WITH BUILT IN BENCH SEATING, ANGLE SUPPORTED DESKS, AND COMPUTERS.

DESIGN PROCESS

DESIGNING THE STAIRCASE TOOK ROUGHLY TWO WEEKS. AND OUR MAIN GOAL WAS TO OPTIMZE THE AMOUNT OF WOOD USED TO MAKE A FULLY FUNCTIONAL AND STRUCTURALLY STABLE STAIRCASE AND WORKSPACE.

THE REBELS AMONG US

Three students wanted to do something different. They realized that they could use the math, design, and woodworking they learned during the semester to create a geodesic hang dome in the common area of High Tech High. The open-ended learning goals allowed for the creation of different products with the same learning outcomes.

ASSESSMENT

Exemplars were used instead of rubrics. When working individually, each student explained their work to the class and teachers. When working in teams, the team presented their work to the class and the teachers, explaining what they learned and what they might have done differently. The multiple assignments built on each other. Students were evaluated on the quality of their revision, and their explanation of what they learned about art, design, math, physics, and teamwork.

“What is the genius of a cardboard box? How much can we do with it?”

Jeremy Manger and Jeffrey Feitelberg had seen a video about a nine-year-old boy who built a cardboard arcade in his father’s auto parts shop in East L.A., which went viral on social media in 2012. They wanted to jumpstart the new school year by engaging students in a fun, hands-on project that included creative play and engineering design principles. Students explored the simplicity and limitless uses of a cardboard box and then built arcade games out of cardboard and other recycled materials.

The process was the most significant part of this project; its most important goal was to introduce students to project-based learning and the importance of collaboration. The project was designed to teach some of the elements of project-based learning in an authentic and explicit manner: collaboration, critique, drafting, reflection, and exhibition.

THE ARCADE PROJECT

JEREMY MANGER • JEFFREY FEITELBERG
THIRD GRADE
HIGH TECH ELEMENTARY NORTH COUNTY

LEARNING GOALS

- To speak, listen, and explain ideas clearly
- To develop writing, editing, revision skills
- To read, analyze, and discuss non-fiction and fiction texts
- To understand multiplication, division, and area and its relationship to multiplication and division
- To understand and become skilled at measurement and graphing
- To understand concepts of force and motion, and to understand and practice engineering design steps

Jeff and Jeremy launched the project by watching "Caine's Arcade" and visiting a real life arcade. The short film by Nirvan Mullick beautifully portrayed the imagination of a nine-year-old and the power of bringing a community together to play games and have fun. Then, third graders were inspired to create a cardboard arcade of their own.

The classes set out to plan an arcade that they would invite the whole community to on exhibition night. The group started by brainstorming possible games that could be built from cardboard boxes; then they broke into smaller groups or pairs.

CARDBOARD ARCADE

RUBRIC

Game Name: _____

Group Names: _____

_____

Circle the emoji that best shows how you are doing.

MY GAME SHOULD...	RIGHT NOW...
Be engaging and fun to play	⌛ 😊 😕 😟
Be beautiful to look at	⌛ 😊 😕 😟
Match our design	⌛ 😊 😕 😟
Make our Kindergarten buddies happy to play	⌛ 😊 😕 😟
Be completed by Nov. 16th.	⌛ 😊 😕 😟

COMMENTS:

Place your comments here!

GRADING SYSTEM

⌛ Done
😊 On Target
😕 Not Yet
😟 Need Help

Game design went through several steps: group brainstorming; designing on paper; receiving feedback and making design revisions; creating a first draft three-dimensional game; receiving further feedback and making revisions; and constructing the final game.

A local Chuck-E-Cheese game engineer met with each student and offered critique on their prototype, playing the game, asking questions, and even donating ping pong balls and other game accessories. During the process of design and building, younger and older students were also invited to try out the games and give feedback.

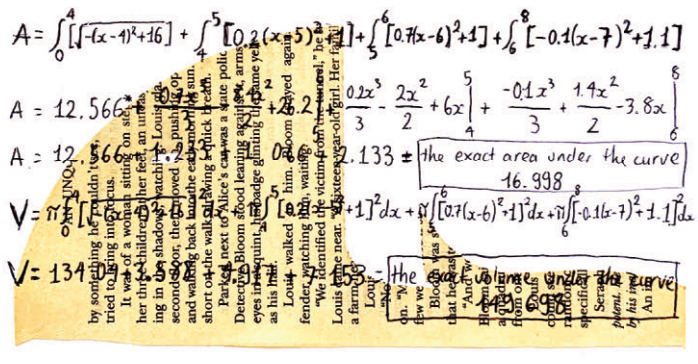
Students and teachers co-created a game rubric to help groups stay on track with what they still needed to improve and to serve as a product assessment tool.

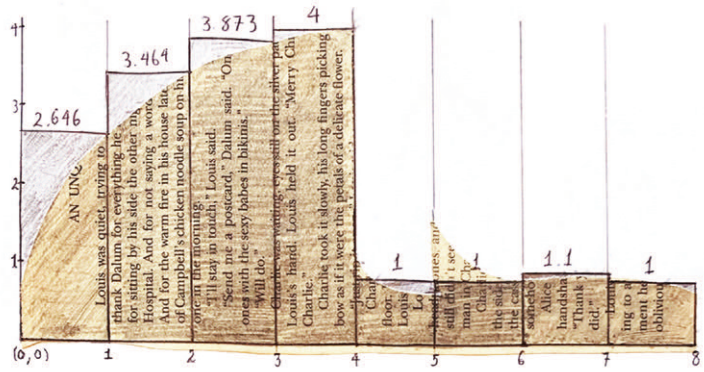
As they were working on designing their games, the class was also reading *This is Not a Box* and *Rosie Revere, Engineer,* two picture books that captured the imaginative genius of children. Students were encouraged to bring their own stories into the classroom to build community. Writing instruction focused on personal narrative, and specifically sharing stories about play with friends and family. Many discussions focused on the nature of games, why kids love them, and how or if they help people make friends.

EXHIBITION

The third grade took over the school's large community space and transformed it into an arcade. Parents and family members played the games and explored the design process that students went through to build them. According to the teachers, displaying the process was important, because while the games provoked curiosity and fun, "it was the design thinking process and joy of building that brought the community together." The next day, the whole school got to explore the arcade, play the games, and offer their feedback.

Tung Tran 2019





ROTATIONAL VOLUMES

DEATH TO BOOKS

TWELFTH GRADE • ENGINEERING • MATH

PHILIP ESTRADA • MELE SATO

HIGH TECH HIGH MEDIA ARTS

Philip Estrada and Mele Sato wanted to do a short collaborative project integrating his physics and engineering class and her calculus class. They were looking at Li Hongbo's paper sculptures, which are solid volumes but can be opened up to show tiny slices inside. They wondered, "Could our students show mathematical volumes in a fun way?"

They had the idea for students to look at rotational volumes by cutting shapes into books and rotating the pages around the axis of the book spine to create a three-dimensional shape. The students would then display these former books as sculptures using their new woodshop skills.

Phil made an exemplar. He learned that he had to use large paperback books with at least 400 pages, and he used a band saw for a finer cut. Phil mounted the book so that all the pages spread to create a rotational volume.

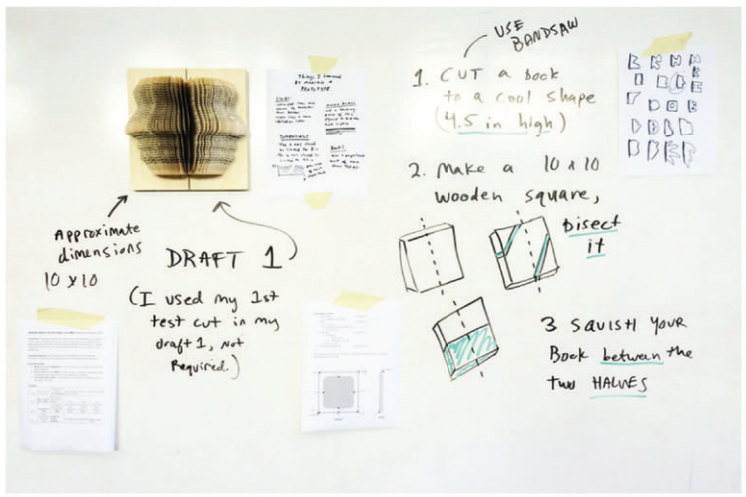
Phil's exemplar: a mounted book and the framed math component.

To start, the teachers showed models and fielded questions to show the students the expectations and learning goals for engineering and math.

Students first drew a line that interested them without worrying if they could cut it or do the math to explain their line. They experimented with what they could do. The students then brought their shapes into math class to learn how to use calculus to describe their line, the volume beneath their line and the volume created by rotating their line around an axis. The students then decided to change their lines or shapes based upon what they had learned in both math and engineering. After they created their new forms, the students used different types of wood joined together to create an individually designed mounting surface to display their Rotational Volumes.

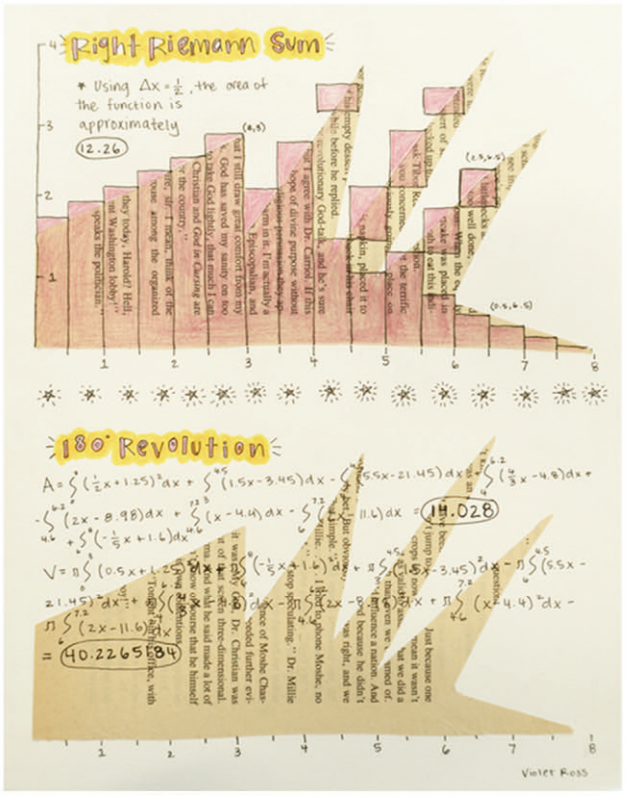
LEARNING GOALS

- To learn the math related to calculating the area beneath a curved line
- To understand the concept of using rotation of a two-dimensional shape around an axis to create a three-dimensional shape
- To learn the math required to calculate the volume of a three-dimensional shape created through this rotation
- To learn woodworking skills



EXHIBITION

The sculptures were displayed at an evening exhibition, with accompanying math posters to explain the equations that described each piece.



JOHN GRISHAM
"And I'm tired of
accommodate you," Ad
slowly back to his
about my ass, twenty-th
chamber, and all you want to
Just keep chirping away,
can start talking about me.
"I filed a petition this mornin
"Fine! Then leave, dammit.
stop tormenting me!"
THE CHAMB
FIV
repeated as he looked at the
of Goodman and Wycoff.
coff quipped.
han said. "You could be
I mean, one lousy vote and
explained. "The votes
ing. Rosen had maybe
stuck with him becau
You have no idea of th
ok place last night.
ne in three month
added Goodma
sick of him."
Adam said.

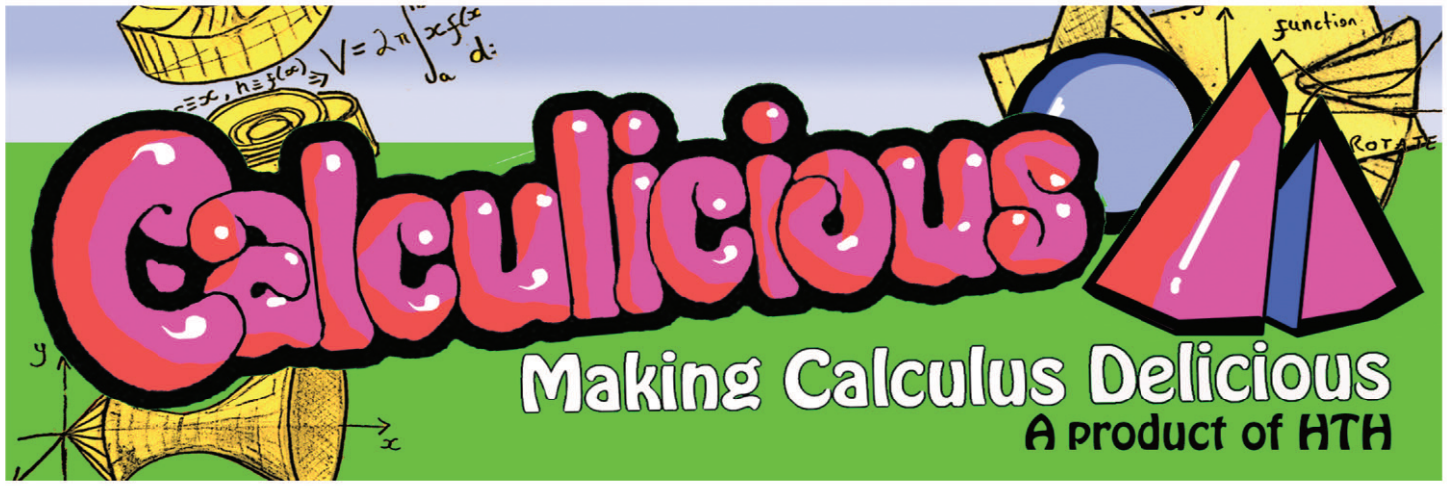
Mariah Smith, "Basquiat in My Parabola"

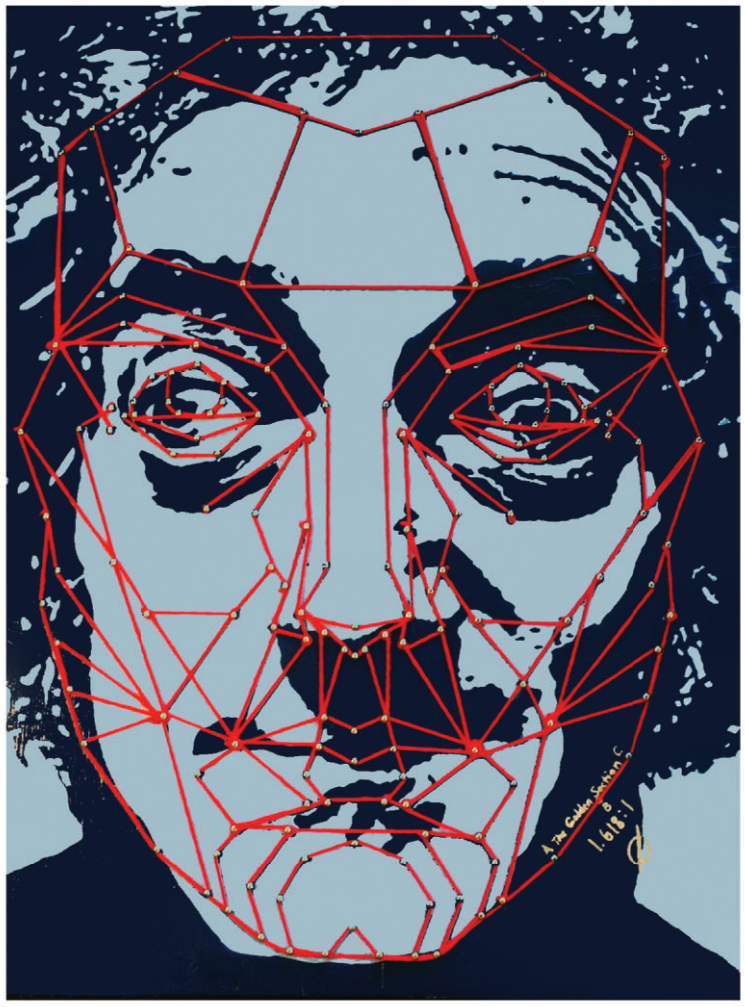
CALCULICIOUS

MAKING CALCULUS DELICIOUS

TWELFTH GRADE • PHYSICS • PAINTING

ANDREW GLOAG • JEFF ROBIN • HIGH TECH HIGH

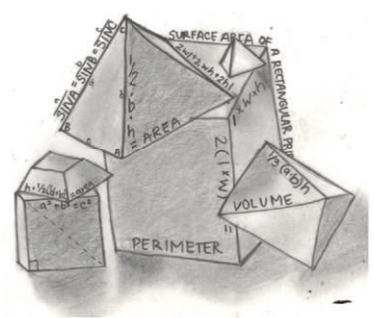


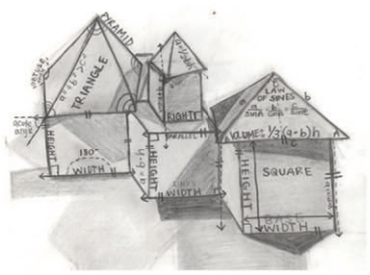


Ana Vargas, "Marty Feldman and the Golden Ratio"

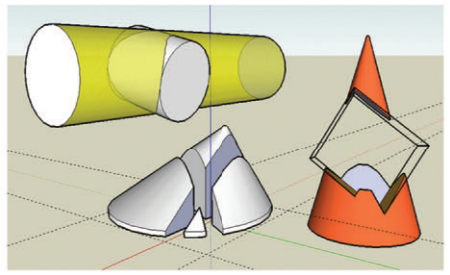
Calculicious was a cross-curricular project where seniors were engaged in using calculus to make and describe art. The summer before, Andrew Gloag, the physics teacher, said that he wanted the students to move back and forth from class to class doing the same work. Jeff Robin thought that the art would make calculus more accessible to everyone—"sticky, even delicious." Andrew is from the UK, and he channeled his inner Austin Powers and said, "Calculicious, Baby."

Dee and Donavan, "The Asteroid"





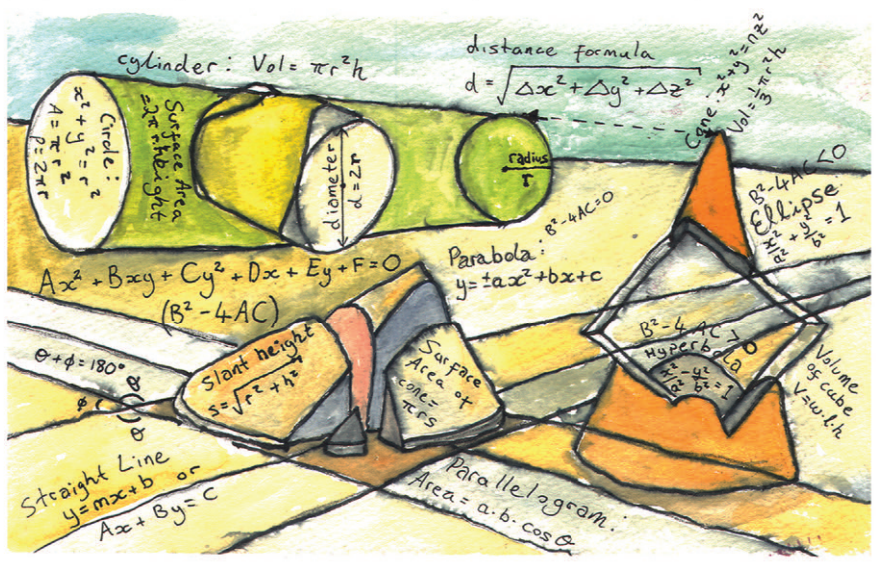
First mini-project with shapes



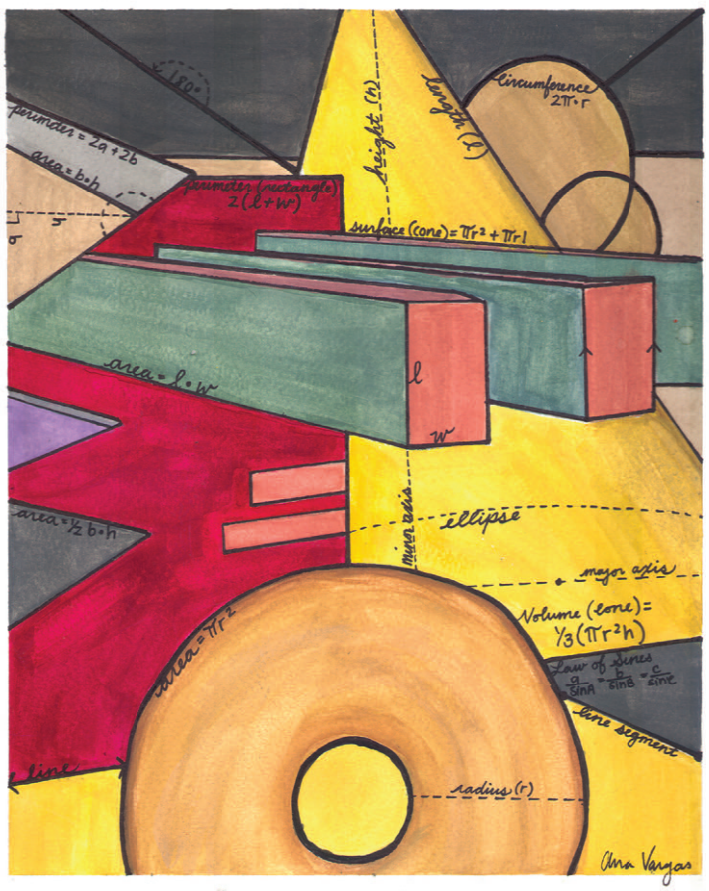
SketchUp conic sections maquette

Students first made paper shapes and drew them. They shaded the drawings and tried different drawing techniques in art class. Then they went to physics and filled in the math and/or calculus on the drawings. This first mini-project would show the students that math and calculus exist in real life, and in the art they make.

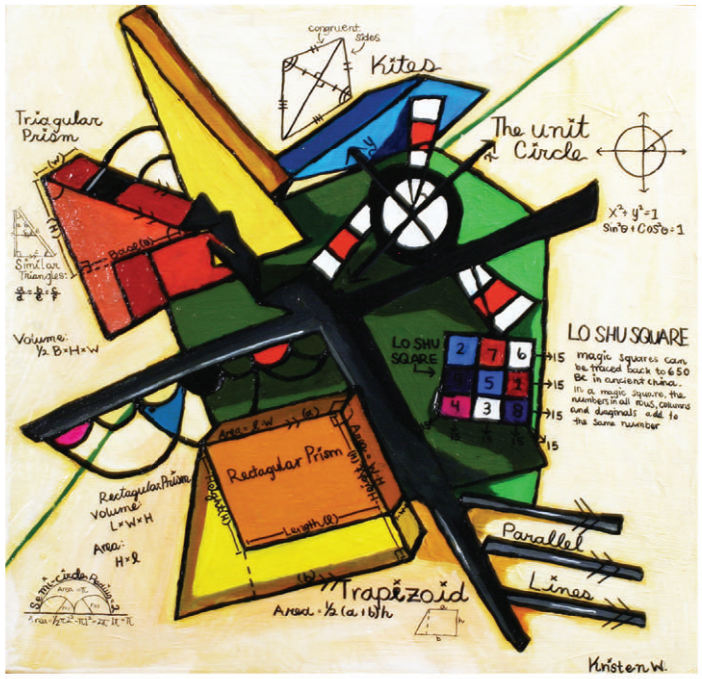
In math, students learned how they could use calculus to describe geometric shapes. In art class, they learned to use SketchUp, a CAD program that lets the user make shapes and intersect them to create an area under a curve, conic sections, and more. The students then made watercolors using this technique of digital designs and calculus formulas. The juxtaposition of shapes, formulas, and watercolors would be dramatic.



Watercolors from SketchUp



The next step was to have the students make larger acrylic paintings that described specific math and calculus concepts that the students were interested in. The students did not have to use the SketchUp images; they could also use a famous artist as a template to describe calculus functions, such as Basquiat, Dali, or Kandinsky. They created their maquettes and used acrylic paint on canvas to illustrate their visions.



Kristin Winfrey, "Kandinsky's Math"

Ramona Cervantes, "Math Under Degas"

Deja Malone-Persha, "Dali's Prism"

Jorge Ramirez, "British Booth"

As the semester went on, the students made sculptures, and used calculus to describe these as well. They welded steel, sewed stuffed animals made of conic sections, and made parabola lounge chairs. Throughout the project, students used an online forum for critique. All the work was commented on by at least three students, who made suggestions, gave praise, and offered constructive criticism. The writing from the online forum became the text in the book of the students' work entitled *Calculicious*.

LEARNING GOALS

- To use calculus and math to explain the physical and artistic world
- To use critique to improve calculus and artwork
- To use SketchUp, watercolor, acrylic paint, and sculpture to make art of meaning and beauty

ASSESSMENT

The students critiqued each other in the online forum and met regularly with both teachers. Student groups from lower grades came to visit the class, and all the Calculicious students had to present what they had done and what they were working on next. These presentations were an excellent opportunity for many students that were never the ones to volunteer to go to the board and explain their math. They got the chance to explain their art and math.

DIFFERENTIATION

The teachers wanted to make calculus delicious to everyone, not just the high flyers. They wanted show students, teachers, and the community that if you can beautifully explain your math, it shows you know your math well. Students got the opportunity to make art and use the math or calculus they could understand; they were not trying to keep up with someone else. They focused on what they were good at and brought that into the project. One example was Kristin's acrylic painting. She had always struggled in math and felt that she could not go on to college because she "couldn't do the math." She was the first to finish her Kandinskyesque acrylic painting and was so proud that she was finally ahead of the pack. She then helped the calculus masters finish their paintings and gave them some useful tips on brushwork.

EXHIBITION

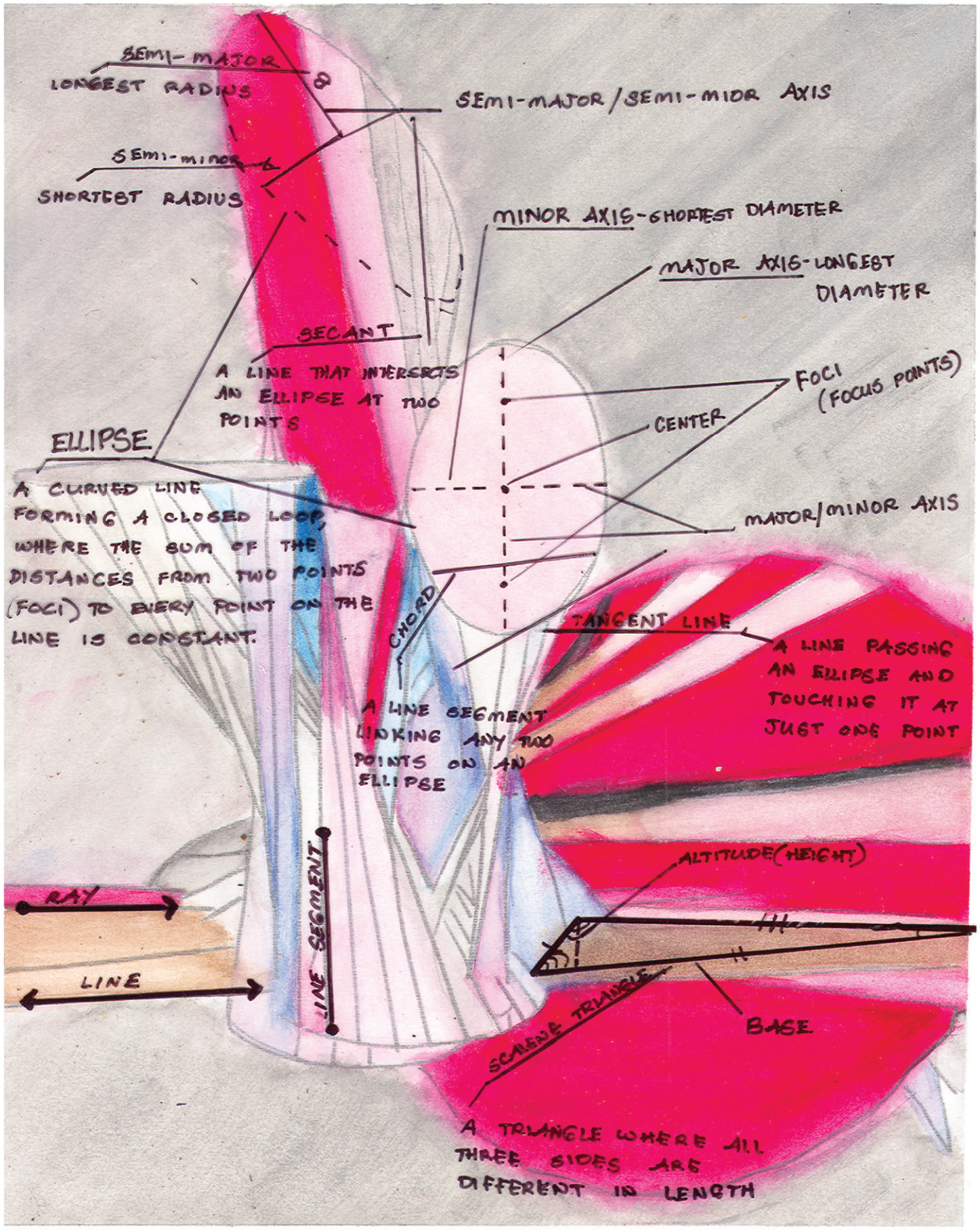
Calculicious was displayed at High Tech High and lives online in web and book form. The work was exhibited at the San Diego International Airport and is currently displayed at the Harvard Graduate School of Education.

Deja and Mariah, "Goldsworthy's Physics"

Courtney and Bev, "Conic Section Toys"

San Diego International Airport

Gustavo and Miles, "Cosine Wave Chair"


SEMI-MAJOR
LONGEST RADIUS
SEMI-MAJOR/SEMI-MIOR AXIS
SEMI-MINOR
SHORTEST RADIUS
MINOR AXIS-SHORTEST DIAMETER
MAJOR AXIS-LONGEST DIAMETER
SECANT
A LINE THAT INTERSECTS AN ELLIPSE AT TWO POINTS
FOCI (FOCUS POINTS)
ELLIPSE
CENTER
A CURVED LINE FORMING A CLOSED LOOP, WHERE THE SUM OF THE DISTANCES FROM TWO POINTS (FOCI) TO EVERY POINT ON THE LINE IS CONSTANT.
MAJOR/MINOR AXIS
CHORD
TANGENT LINE
A LINE PASSING AN ELLIPSE AND TOUCHING IT AT JUST ONE POINT
A LINE SEGMENT LINKING ANY TWO POINTS ON AN ELLIPSE
ALTITUDE(HEIGHT)
RAY
LINE
LINE SEGMENT
SCALENE TRIANGLE
BASE
A TRIANGLE WHERE ALL THREE SIDES ARE DIFFERENT IN LENGTH

“Walk a mile in my shoes”

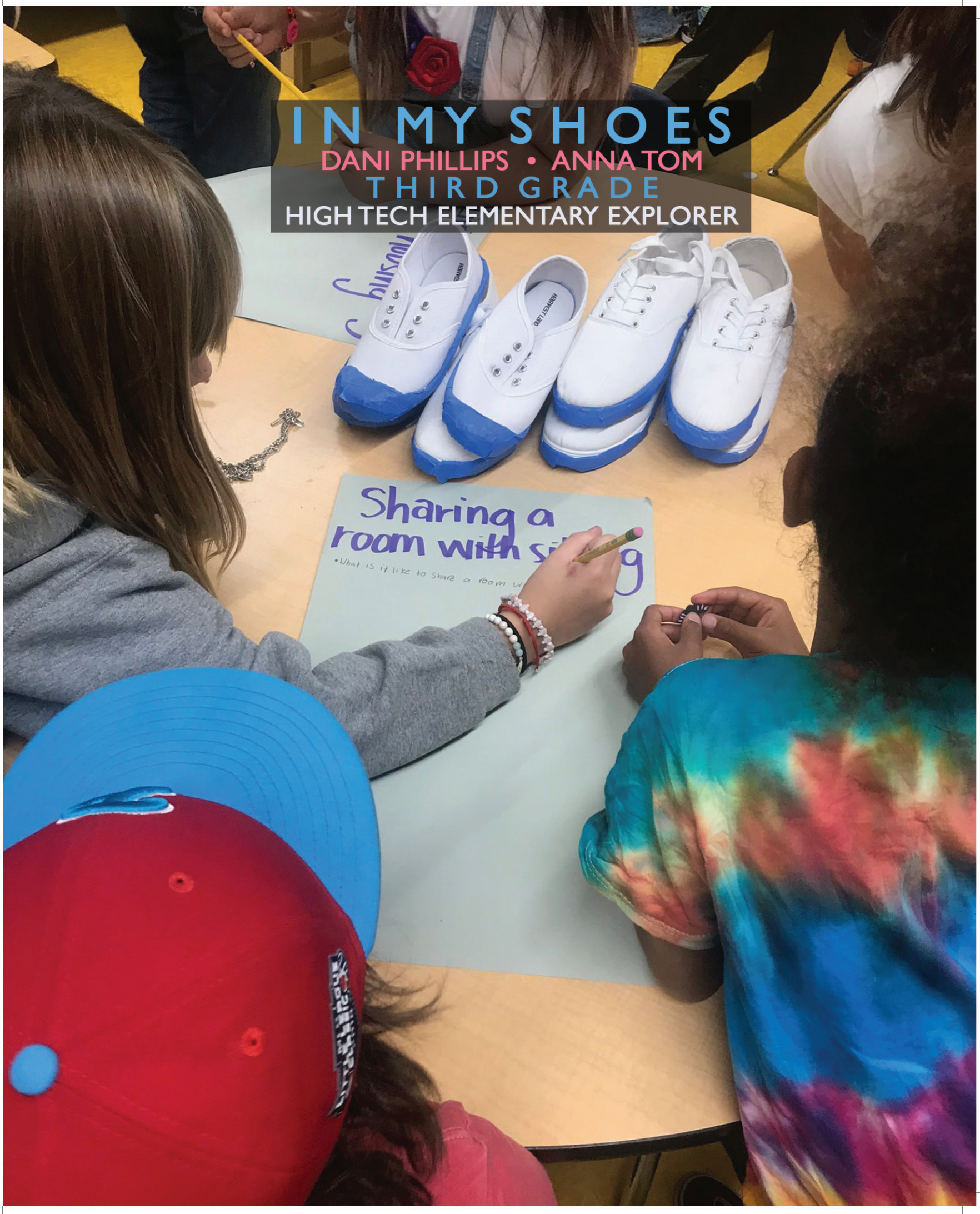
is a way of saying “see things from my perspective.” But shoes are also a status symbol and a marker of inequity. Dani Phillips thought these two aspects of shoes could make them the perfect entry point for a study of identity and diversity. To prepare, she and Anna Tom listened to songs about shoes, watched documentaries on shoe designers and shoe collectors, and planned reading material around sustainability issues within shoe production. Using the Teaching Tolerance standards, they were able to make their study of shoes a vehicle to teach about identity, empathy, injustice, and activism.

They launched the project with a mystery challenge—staff members contributed photos of their shoes, with snippets about where the shoes had taken them. The students needed to match the shoes to the people, learning and reflecting on their inference process and creating a collage of staff members that hung outside the classroom for the rest of the year.

Dani and Anna created an extensive reading list of fiction and non-fiction about shoes and also about identity and diversity. Reading was differentiated and students had a choice in what they read. For whole group reading and learning, the class read about Michael Jordan and the Air Jordan designer Tinker Hatfield, and about the Disney designer Mary Blair. One of the most intensive whole group reading and writing exercises was a close reading and analysis of the Mackelmore song Wing$, a first person story of a boy’s obsession with brand name sneakers and his growing understanding of the negative impact of the brand status of products.

IN MY SHOES

DANI PHILLIPS • ANNA TOM
THIRD GRADE
HIGH TECH ELEMENTARY EXPLORER



LEARNING GOALS

- To develop a strong sense of belonging
- To feel confident in voicing opinions about difficult subjects
- To develop a deep appreciation for differences among people
- To understand empathy and practice it
- To learn and practice the design process, including research, prototyping, testing, and revision
- To develop as readers, writers, and editors
- To develop critical and analytical thinking
- To apply data analysis techniques to multiple kinds of survey data collected (about shoes)
- To learn about mean, median, and mode, and standard and non-standard units of measurement

Throughout the project, Dani and Anna used many interactive exercises to bring the sometimes abstract concepts of identity, equity, and social justice to a concrete level that engaged third graders. The class demonstrated the concept of privilege by playing basketball, calling their shots "shots at privilege." Students took a layup shot at life, a free throw shot at life, or a three pointer, and then made analogies to other kinds of "shots" or life chances.

Students were challenged to take a plain pair of white sneakers and create a design for them that expressed the student's individual identity. Students knew they would be limited to two techniques: airbrushing and vinyl transfer. They practiced and experimented with the techniques to see what was possible. The students researched various shoe designers, as well as do-it-yourself designers on Etsy. They created drafts on paper and gave and received critique.

PRODUCTS

- Shoes
- Narrative identity statements
- A process magazine, with essays from each student about various aspects of the project process
- Narrative writing about the history of their name
- Empathy shoe boxes, in which students created challenging scenarios (such as divorce or not making a team) and suggested solutions
- Posed photography and identity statements

EXHIBITION

The students staged a fashion show to exhibit their identity shoes and poses. The design process and prototyping of the shoes was on display, as well as the writing components, and the musical analysis of Mackelmore's song Wing$.

Emily Alvarado Cervantes

In my shoes I am brave because I never give up. These shoes make me feel brave because it is like giving me powers to be brave all the time when I need it. With these shoes I'm brave and it is exciting. I'm always happy, too because I do not give up even if I feel like it. In my shoes, I do not give up and I'm brave.

In my shoes I will go to school wearing these. I will wear them almost everywhere. I would go to watch a movie. I will be happy because I'm in my shoes. If we read Pete the Cat it will be funny because my shoes are Pete the Cat. I will always be wearing my shoes everywhere I go and it will be happy and exciting.

In my shoes I can show how to help the people that help the sea animals. I can pick up things that hurt the sea animals. In my shoes, I can do a cartwheel outside with all of my friends looking at me. I can go to a shop wearing my shoes and everyone would say my shoes are awesome.

In my shoes, I am funny. I am nice. I am happy. I am Emily and these are my shoes.

"Imagine Coachella times Physics. It was like a rave."

Chris Wakefield was inspired by a Spanish artist, Ana Soler, who created an installation using thousands of tennis balls to illustrate the arcs of bouncing balls. But...she didn't get the physics right!

Chris hoped his students would be inspired by the challenge of creating a similar exhibition, but get the math and physics equations right. He launched the project by showing his students photos of the art installation and the somewhat daunting displacement equation, $\Delta x = V_o t + \frac{1}{2} at^2$. Several of his students were into composing electronic music, and they suggested adding a musical component to the work.

After the initial challenge, students spent the first week doing hands-on inquiry activities. Students dropped balls and caught them, documenting their position with the naked eye and photography. They experienced force as a feeling in their hands when catching balls dropped from varying heights. Then they made inferences about what they had seen and felt. Chris had a photography app that took bursts of photos at regular 0.1 second intervals and then stitched them together. They put these up on the screen and then used Google Draw to trace and measure vertical and horizontal distances of an object's trajectory.

LEARNING GOALS

- To use physics and trigonometry to calculate the trajectory of objects dropped or launched at an angle
- To explain and illustrate velocity, gravity, and the displacement equation to a person unfamiliar with the math

After getting a sense of the equation physically through experimentation, students spent the next two weeks learning the equation and using it to solve real world problems. For example, "a punter kicks a football at an angle of 30° from the ground at an initial speed of 20 m/s. Where should a punt returner position themselves to catch the ball just before it strikes the ground? Also, what would be the maximum height of the ball?"

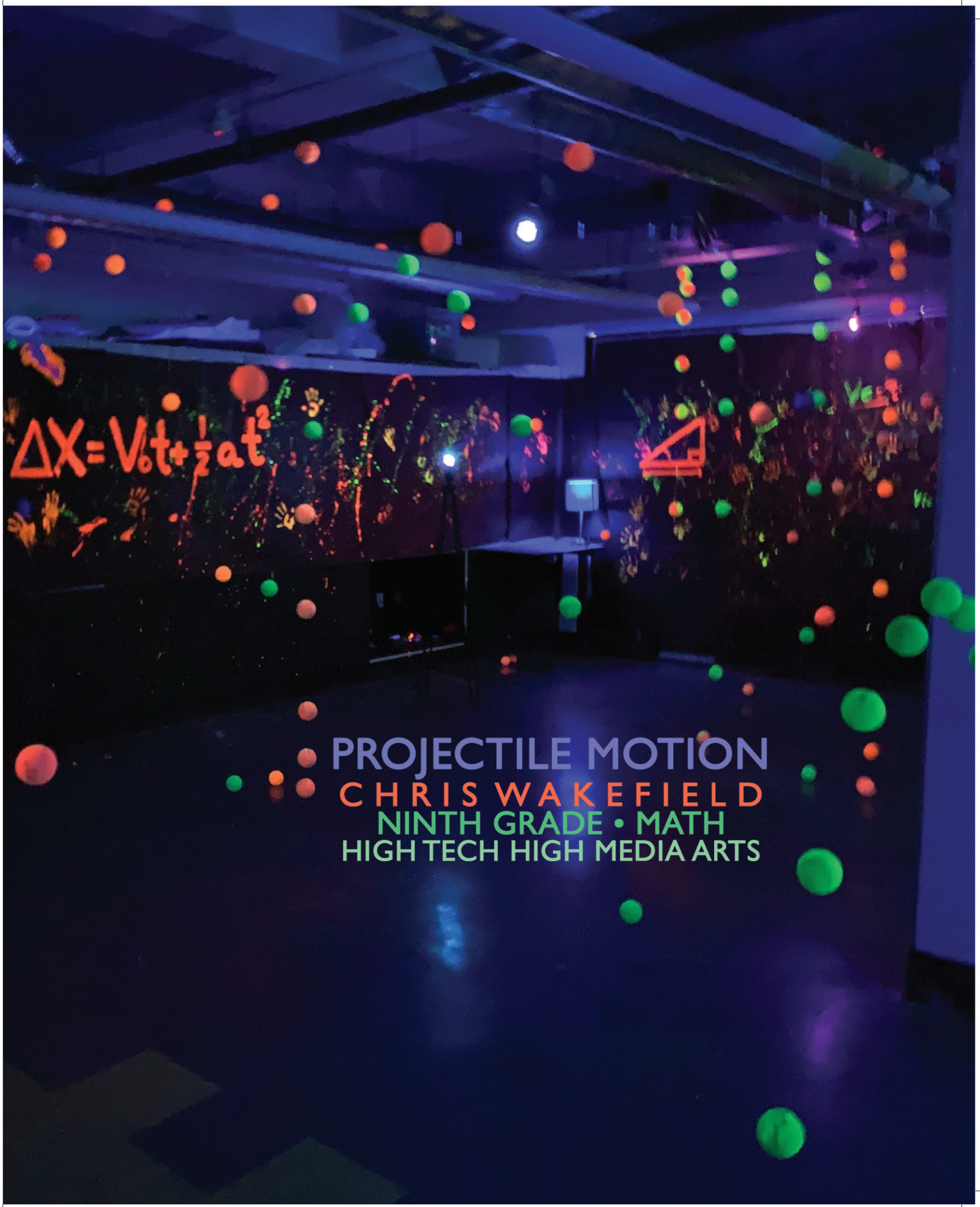
DIFFERENTIATION

Chris built in differentiation and allowed students to choose the level of challenge they wanted. For each level, students needed to do the calculations and create an installation showing the tennis ball's trajectory. Three levels were offered:

Mild: Students calculated the horizontal displacement for an object moving at a constant velocity at 0.1 second intervals.

Medium: Students calculated the vertical displacement of an object in free fall at 0.1 second intervals.

Spicy: Students started by using trigonometry to determine the horizontal and vertical components of the initial velocity of an object launched at an angle. Using four variations of the displacement equation, students calculated the horizontal and vertical displacements of objects at calculated time intervals to show the parabolic nature of motion.

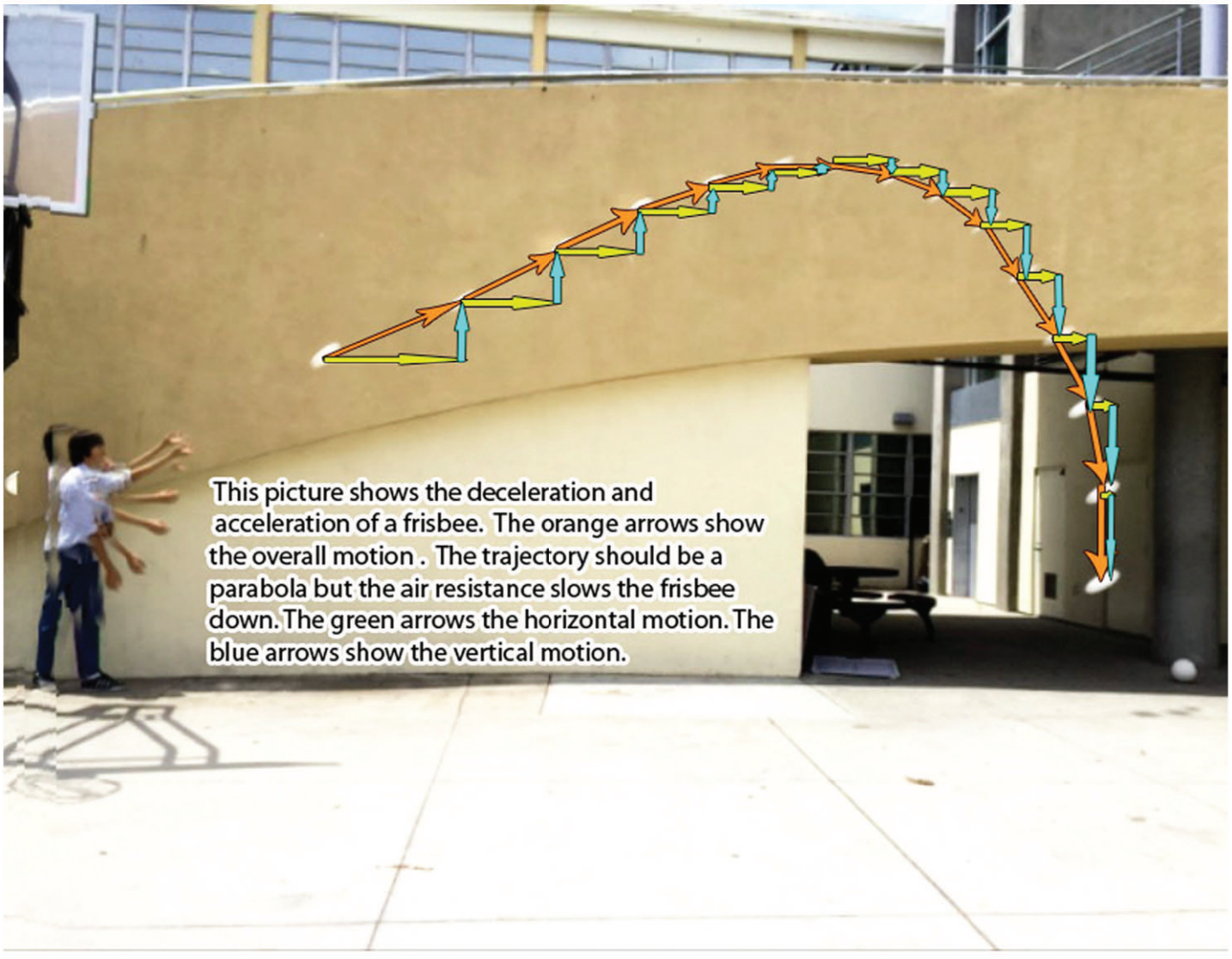

$\Delta X = V_0 t + \frac{1}{2} a t^2$
PROJECTILE MOTION
CHRIS WAKEFIELD
NINTH GRADE • MATH
HIGH TECH HIGH MEDIA ARTS

Once students had decided what they wanted to do, they paired up with others who had made the same choice. Chris advised them that the challenge option would require putting in some time during lunch and after school. Interestingly, there were several students who were a couple of years behind in math, but they still wanted to do the challenge option, because it looked like more fun.

EXHIBITION

Students painted tennis balls neon colors and used fishing line to hang them at heights that corresponded to their calculations. They blacked out the walls and used black lights, creating a rave atmosphere. Two students DJ'ed the exhibition with music they created. It was easy for students to self-assess their calculations, because if they were incorrect, the trajectory they displayed would not look right.

Students wrote up the calculations that informed their installations and displayed these outside the exhibition. They had to prepare a twenty-second "elevator pitch" explaining the math, and a longer five-minute explanation for those who were interested in hearing more.



This picture shows the deceleration and acceleration of a frisbee. The orange arrows show the overall motion . The trajectory should be a parabola but the air resistance slows the frisbee down. The green arrows the horizontal motion. The blue arrows show the vertical motion.

STEP: 1

SOH: $\sin\theta = \frac{OPP}{HYP}$ $8\cos 75 = \frac{V_{ox}}{8}$

CAH: $\cos\theta = \frac{ADJ}{HYP}$

TOA: $\tan\theta = \frac{OPP}{ADJ}$ $8\sin 75 = \frac{V_{oy}}{8}$

HYPOTENUSE 8m/s V_{oy} OPPOSITE 75° V_{ox} ADJACENT

X:		Y:	
ΔX_x:	3.2m	ΔX_y:	3.08m
V_{ox}:	2.07 m/s	V_{oy}:	7.72 m/s
V_{fx}:	2.07 m/s	V_{fy}:	0 m/s
a_x:	0 m/s²	a_y:	-9.8 m/s²

STEP: 3

find time using equation $V_{fy} = V_{oy} + a_y t$

$0 = 7.72 + (-9.8 \cdot t$

$-7.72 \quad -7.72$

$-7.72 = 0 + (-9.8 \cdot$

$(-7.72 \div (-9.8 = 0.78$

$0.78 \times 2 = 1.56$

t: 1.56 Givens: (-9.8, a_y, 0, V_{oy}: wrote in our givens

STEP: 2

find time for first half of problem, then multiply by two to find landing spot

STEP: 4

$\Delta X_y = V_{oy}t + \frac{1}{2}a_y t^2$ use equation to find height

$\Delta X_y = 7.72t + (-4.9 \cdot 0.78^2$ of ball on the way up

$\Delta X_y = 6.02 + (-2.94 = 3.08$

STEP: 5

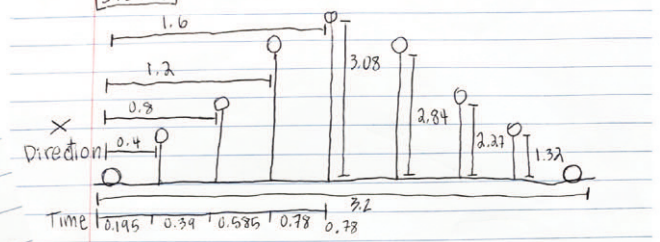
use the time for the entire distance in this equation, then find total horizontal distance.

$\Delta X_x = V_{ox}t + \frac{1}{2}a_x t^2$

$\Delta X_x = 2.07 \cdot 1.56 + (\frac{1}{2}0 \times t^2$

3.22

STEP: 6 Find the distance between each ball



STEP: 7 calculate the height between each ball

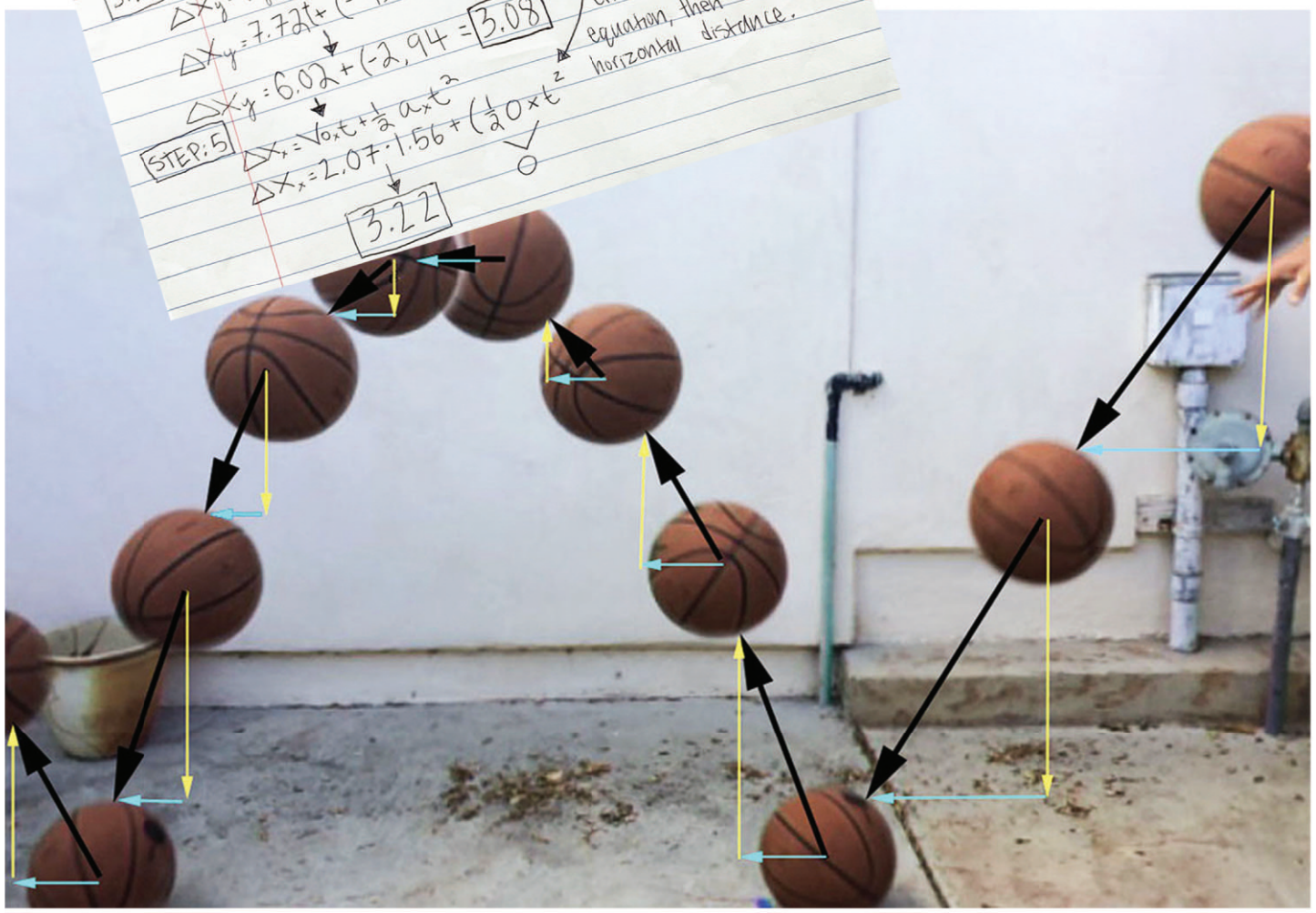
$\Delta X = Vot + \frac{1}{2}at^2$

$\Delta X = 7.72 \cdot 0.195 + (-4.9 \cdot 0.195^2) = 1.32$

$\Delta X = 7.72 \cdot 0.39 + (-4.9 \cdot 0.39^2) = 2.27$

$\Delta X = 7.72 \cdot 0.585 + (-4.9 \cdot 0.585^2) = 2.84$

$\Delta X = 7.72 \cdot 0.78 + (-4.9 \cdot 0.78^2) = 3.08\ (3.03)$



Does greed advance technology?

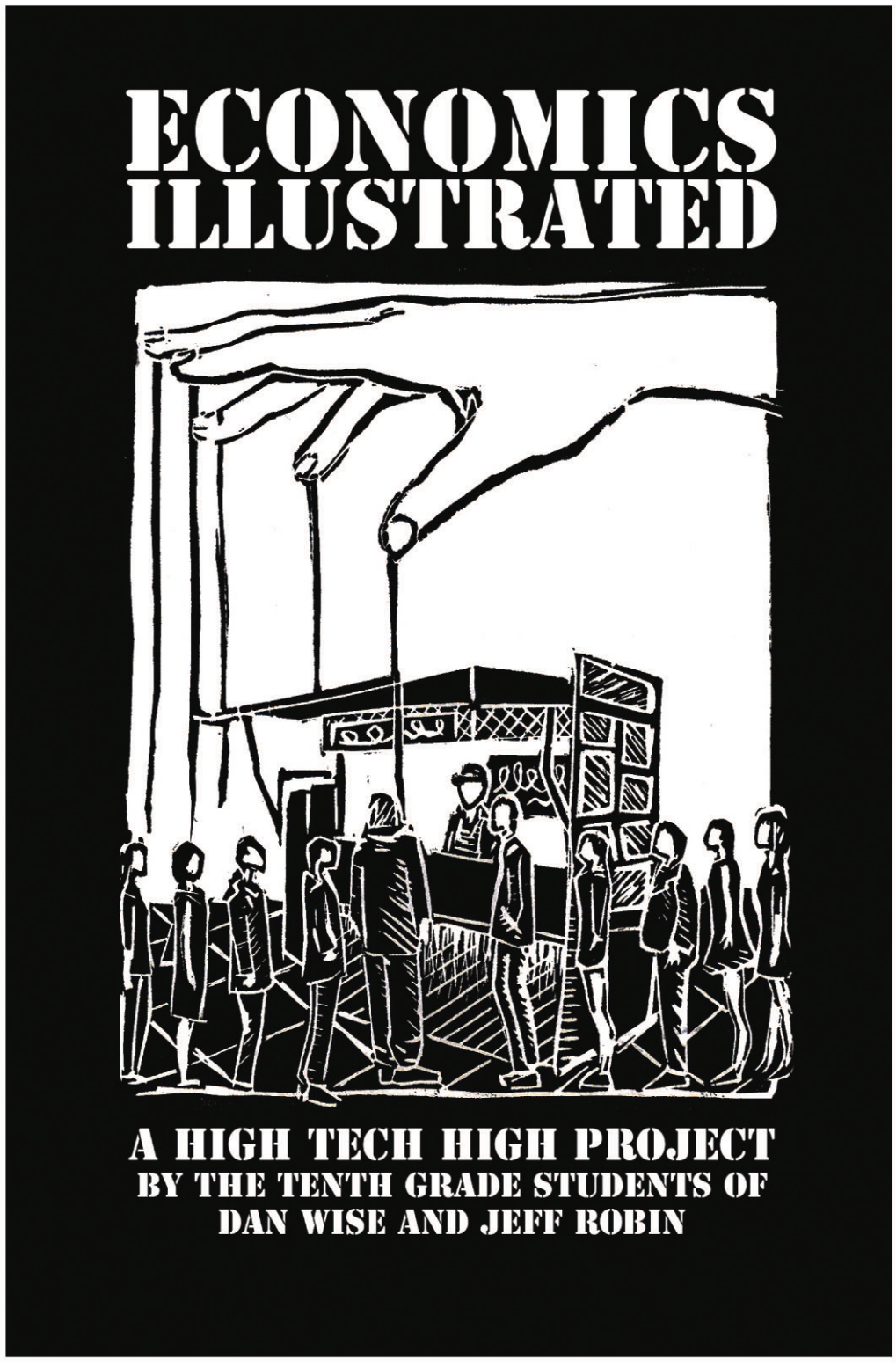
Will buying American create new jobs? Dan Wise wanted his students to "see the world through the lens of economics." In looking for accessible books that could help them understand economic concepts, he realized there weren't very many. So, with the help of art teacher Jeff Robin, they decided to make their own.

The result was *Economics Illustrated*, a book in which students explained and illustrated an economic concept of their choosing and wrote an article that applied the concept to an issue they cared about. One student who was into sports, for example, chose the concept of collusion and applied it to salary caps in professional sports. Another student chose supply and demand, and applied the concept in an article about the housing market crash of 2008.

Dan launched the project with a couple of simulations, including the Dictator Game, (students get ten dollars and have to decide how much to give to another person—most divide it in half, rather than keeping it all for themselves) creating the element of surprise and stimulating conversations about human behavior and money. Early on, he surveyed students to learn what aspect of economics they might be most interested in, and used that data to guide students' choice of a concept to explore.

ECONOMICS ILLUSTRATED

DAN WISE • JEFF ROBIN
TENTH GRADE • HUMANITIES • ART
HIGH TECH HIGH



The Invisible Hand

Camille Gomez

The invisible hand is a metaphor that describes how individuals acting in their own self interest unintentionally benefit society by producing and purchasing the goods and services that are wanted and needed.

Example 1: In America, there is no authority that tells stores what to stock on their shelves or what items to sell. Stores decide on what to order from manufacturers based on what they think will bring in the most customers. When store managers sell the items that customers want, at prices that they are willing to pay, then the stores benefit by making a profit. Also, to stay in business, manufacturers will produce the items that stores want, therefore creating a system in which people are able to purchase what they want and need. All of this is done through the providers (those making the products and selling them) thinking of the most profitable outcome for themselves.

Example 2: Car companies are currently working on creating cars that get better gas mileage than older models do. They know that by doing this many people will opt for their cars and will be willing to pay a little extra (increasing the companies' profits). Those who want to buy these cars are acting in their own self interest to save money, as the car will, no doubt, pay itself off within time. People are saving money in the long run, companies are making a profit, and America can spend less money on oil from other countries. Everyone is benefiting by thinking of his or her personal gains.

Example 3: Imagine a busy supermarket. Individuals are getting in line at the registers to check out their purchases. Thinking of the best way to save time (acting in self interest), they choose to wait in the shortest line available. When all of the customers are thinking this way, then eventually the checkout lines end up having the same number of people in each. This happens naturally without any guidance or direction other than each individual's self interest acting as an "invisible hand."

Dan had developed a reading list, including *Freakonomics*; *Naked Economics: Undressing the Dismal Science*; *The Undercover Economist; The Armchair Economist; Hidden Order: The Economics of Everyday Life; Super Freakonomics;* and *More Sex is Safer Sex: The Unconventional Wisdom of Economics.* Though all of these were popular economics books, some were challenging to read for 10th graders. Dan started out by having the whole class read excerpts from some of the books together. Then the class broke into literature circles and each group tackled a different book.

LEARNING GOALS

- To better understand global phenomena through the use of economic concepts
- To write about a complex issue, effectively using evidence, ideas, and analysis
- To improve writing, revision, and critique skills
- To learn block printing techniques
- To use art to powerfully and effectively communicate ideas

Dan chose a series of economic terms or concepts that students could choose to focus on, such as the *invisible hand, elasticity, market externalities, free riding, opportunity cost,* and *public goods.* Once they chose their concept, they needed to define it clearly, come up with several real world examples, and choose one issue to apply it to and research its impact.

The book's illustrations took the form of block prints, which for most students was a new technique, and one that proved accessible to many. "I can't paint, I'm not artistic," said one student, "but I was able to create really cool images by carving out blocks." In art class, students learned the technique with a series of mini-projects, leading up to their final series of prints which illustrated their economic concept. Jeff demonstrated how to use carving tools and block printing techniques, and then let the students find the artist within themselves. The students made prints every day in art class while creating their articles and explanations of the economics concepts in humanities class. They bounced between classes, proposing ideas and images to explain their economic concepts. The students had to decide what image would help illustrate their meaning the most effectively. As Jeff explained, "Dan was the editor, I was the art director, and the students were the creative force expressing themselves within the parameters of a real-life economics project. The students learned what it was like to be an economist, journalist, and artist."

While each student went into depth in their own concept and research topic, Dan wanted them to have a breadth of understanding about basic economics as well. "It was important to me that the students' work be intelligible to their peers, so, as a final component, I asked each student to deliver a lesson on his or her concept, with their book pages serving as a handout. As a last lesson in incentives, each student's grade was partially determined by how well his or her peers performed when quizzed on the student's term."

Greed Advances Technology?

Camille Gomez

The invisible hand does not apply to all matters in society, but in the case of incentives for producers and consumers, it works magnificently.

The invisible hand is the theory that shows greed in society as a positive thing. However, if it worked in all situations, society would be more harmonious and untroubled than it is now. The invisible hand does not apply to all matters in society, but in the case of incentives for producers and consumers, it works magnificently. Companies will continuously make a profit by updating features on laptops that customers want, and this benefits the buyers as these new features make their work easier and their lives more enjoyable.

People rely on laptops and the internet for various things: renting movies, ordering off the web, keeping in touch, writing papers, storing information etc. Huge companies, offices, and business-men require their use along with average individuals; the laptop has become a widely used product. It has been shown that producers will take a commonly used product and make it better in the interest of self gain, which also benefits all who use the product.

A specific example of the constant development of laptops is the PC Notebook. The PC Notebook was first developed in the 1970's, although it took many different versions to make it cheaper, smaller, and more efficient. The first PC Notebook of 1972 was extremely heavy and chunky, had limited features, and was expensive. Still, its development was an incredible technological breakthrough for its time. It became an example for future designs, and with every try there were more efficient versions. Now, the PC Notebook is barely five pounds, can easily be slipped into a bag, has high speed internet almost anywhere, and has a battery life of more than two hours.

Laptops are relatively durable and can last for years, so the only way that companies can continue to make money off of them is by coming out with ones that are better than the latest versions. In the thought of saving money, companies and designers focus on the main aspects of the laptop that would appeal most to consumers. For example, when talking over the web with video chat became the latest trend among computer users, companies worked on designing high speed, high definition web cams.

It can be argued that society advances with selfish acts. As with the PC Notebook and other technological advances, most incentives have to do with material, financial, or reputational gain. It's possible that a more efficient device will replace the laptop, such as the iPad. The invisible hand would be guiding designers and inventor's to make a more efficient product with the intention of making a profit. This would benefit all who buy it. The invisible hand theory does not apply to all situations but properly explains the functions and incentives of manufacturers, businesses, and companies.

SCAFFOLDING AND DIFFERENTIATION

The early survey helped Dan guide students toward a concept they would be interested in and the book they would read; he also made suggestions so that the groups would be mixed. Some of the students had one-on-one academic support, both in breaking down the reading, and in writing.

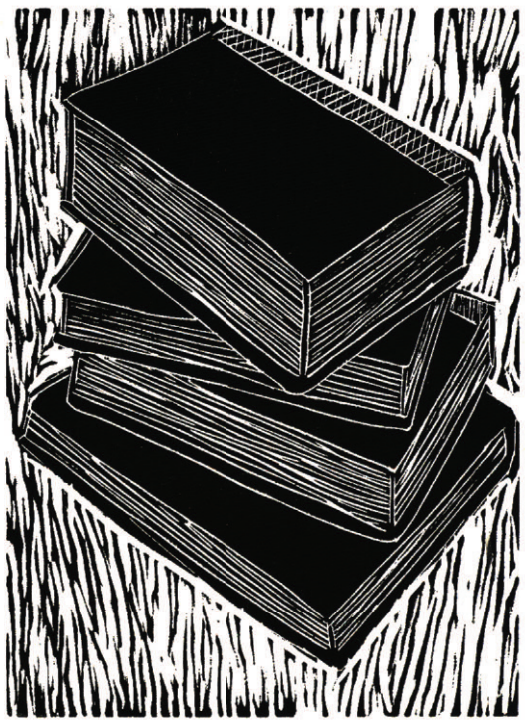
Everyone completed their section of the book, and there were also other creative projects that students could choose from or propose, such as videos, songs, magazines, and simulations.

EXHIBITION

Books were displayed and sold at the exhibition. Jeff printed large posters of the book spreads and the original block prints were exhibited.

Students performed original songs, raps, and plays about economic concepts, and displayed fictional and journalistic writing. Others reported on experiments and surveys or ran simulations to illustrate particular economic concepts.

After the exhibition, the project continued to be displayed. The posters and artwork were hung at the corporate headquarters of City National Bank, causing a minor scandal, as one student compared banks to loan sharks. The project was featured on the Freakonomics blog from the *New York Times*, and some of the posters ended up in the halls of the Harvard Graduate School of Education.



COME PLAY WITH US

STACEY STEVENSON • PATRICIA LIM

KINDERGARTEN

HIGH TECH ELEMENTARY EXPLORER

High Tech Elementary Explorer had a run-down grassy area as a part of its playground, and a real shortage of options for creative outdoor play. Patricia Lim and Stacey Stevenson decided to create an inquiry-based project about the nature of play, in the hopes it could ultimately transform the underused space into a nature playground.

They began their project by asking some open-ended questions:

Why do children like to play?
How do they like to play?
What allows children to be creative, to pretend, to build, to be active?

Sound Wall

Stacey and Patricia launched the project with a trip to a nature playground, where their classes played for hours and also reflected on how they played, and how the materials they encountered encouraged them to play. In the following days, when they were back at school, they observed other students playing. Finally, based on their observations and field work, they began a process of re-designing the run-down play area. Children made sketches of their ideas, and gave and received critique from classmates as well as older students and adults in the school. They voted on final ideas for various areas of the playground, which ultimately included a sand house for pretend play, sticks and rocks for building, stumps for balancing, a water wall, a music/sound wall, and a giant tire for climbing.

The final weeks of the project were spent building. Each group also created safety rules for each play area, and wrote how-to books to teach other children how to use the new play area.

LEARNING GOALS

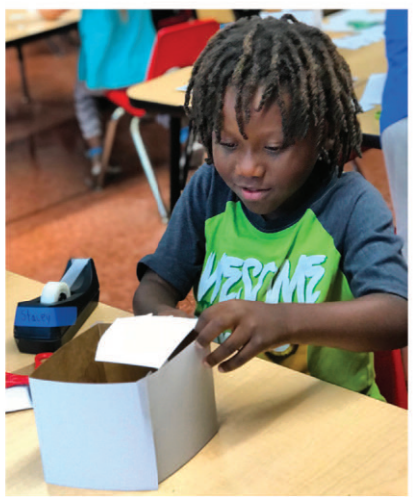
This project met many standards for kindergarten learning, including counting, measuring, data collection, observation, reflection, persuasive speaking, drawing a model of a proposed solution, giving and receiving critique, and writing informational how-to manuals. Social and emotional learning goals included collaboration, negotiating over final products, analyzing what makes playtime fun, and understanding and creating rules for play spaces.

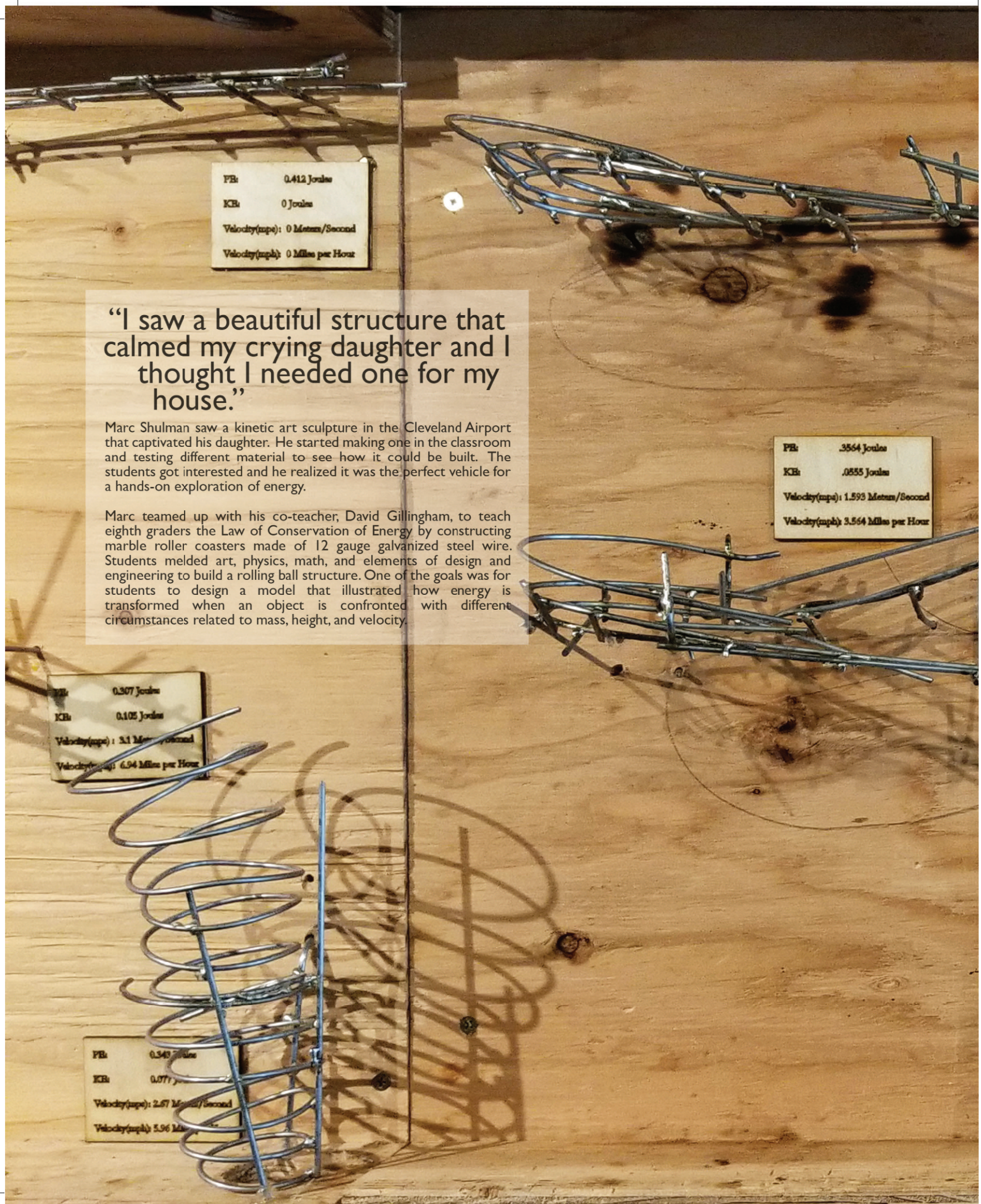
ASSESSMENT

Throughout the project, there were many opportunities for assessment, including presentations, observations, sketches, critique, and writing.

SCAFFOLDING AND DIFFERENTIATION

As this was a first project for kindergarteners, the topic was designed to be fully accessible. Everyone plays differently, but everyone can play; everyone can think about what they like to play. Collaboration, critique, and decision making were scaffolded with practice and direct instruction. Many students needed more support with sketching and writing; teachers and special educators provided this one-on-one or small group support.





"I saw a beautiful structure that calmed my crying daughter and I thought I needed one for my house."

Marc Shulman saw a kinetic art sculpture in the Cleveland Airport that captivated his daughter. He started making one in the classroom and testing different material to see how it could be built. The students got interested and he realized it was the perfect vehicle for a hands-on exploration of energy.

Marc teamed up with his co-teacher, David Gillingham, to teach eighth graders the Law of Conservation of Energy by constructing marble roller coasters made of 12 gauge galvanized steel wire. Students melded art, physics, math, and elements of design and engineering to build a rolling ball structure. One of the goals was for students to design a model that illustrated how energy is transformed when an object is confronted with different circumstances related to mass, height, and velocity.

KINETIC COASTERS

MARC SHULMAN • DAVID GILLINGHAM

MATH • PHYSICS • ENGINEERING • EIGHTH GRADE

HIGH TECH MIDDLE MEDIA ARTS

HUSKY

LEARNING GOALS

- To understand the law of energy conservation, potential and kinetic energy, energy transformations
- To understand and measure acceleration and velocity
- To understand centripetal force and radial acceleration
- To solve multi-step algebraic equations
- To do unit conversions
- To develop engineering design skills
- To become competent in the technical skills of soldering, brazing, precise metal forming
- To write, edit, revise, and illustrate technical documentation

Throughout the design and construction process, students explored the dynamic nature of energy and performed calculations to determine how much kinetic energy, potential energy, and velocity the marble possessed at each significant moment in their roller coaster.

Students were also tasked with creating a poster that illustrated the technical process and mathematical thinking involved in designing and building their structure. The final products were assembled in a permanent installation in the school.

ASSESSMENT

Assessment was rooted in the student work itself, and took place informally. The teachers met with each group regularly, asking them to explain how they had made their structure and why, and posing hypothetical questions about what would happen if variables such as the shape of the structure or the weight of the ball or velocity were changed.

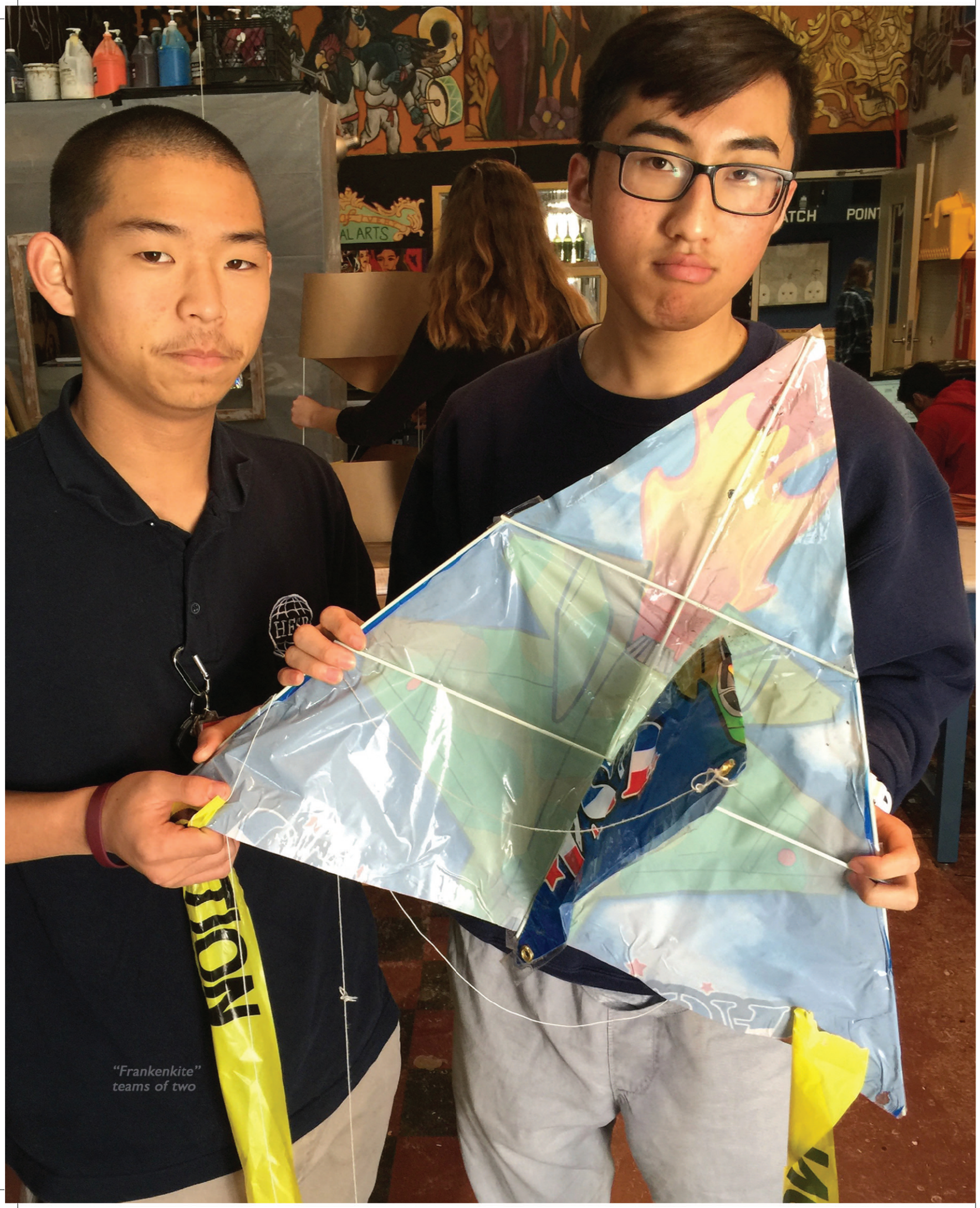
SCAFFOLDING AND DIFFERENTIATION

Many students needed individual or small group support in the procedural elements of the project, i.e., how to solve complex equations. Academic coaches created graphic organizers to help break this process into steps, and supported students with practice and repetition. The conceptual understanding came from hands-on experimentation of trying multiple variations of ball size and weight, slope of structure, and velocity.

Marc and David grouped students in ways that they could help each other with their strengths. For example, a student who had deep conceptual understanding, but could not solve equations well, would be paired with a student who could easily do math on paper but struggled to explain it conceptually.

EXHIBITION

Students held two exhibitions. The first was a process exhibition halfway through the project, so students could get feedback and parents could interact with their designs. At the final exhibition eight weeks later, the structures were installed on a wall, so interaction was more difficult because of the crowd. Instead, students used their classroom to create a hands-on workshop to teach parents and other attendees the skills they had learned. They created a schedule of workshops that participants could sign up for, including brazing, welding, wire forming, how to calculate force and acceleration, and how to calculate velocity and energy.



"Frankenkite" teams of two

A FIGHT WITH GRAVITY

KITES • BALLOONS • FLYING OBJECTS

TWELFTH GRADE • ART • PHYSICS

ANDREW GLOAG • JEFF ROBIN • HIGH TECH HIGH

After many partnerships visualizing physics and math, these two teachers wanted the students to document their own physics experiments. Students would understand physics by attempting to fight gravity using kites, balloons, and other flying objects of their own creation. Attempting to challenge Earth's gravitational pull with craftsmanship, experimentation, observation, and documentation was what this project was all about.

Hot air balloon test: "Slice of Pepperoni" with kindergarten watching

KITES
(first 4 weeks)

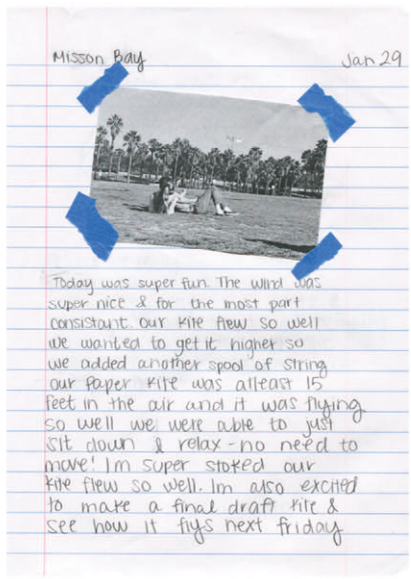
Each team of two students got a kite from the dollar store and a black-and-white composition notebook. They were tasked with documenting how to get their kite to fly. They went to a field near campus and flew their kites. The students wrote about the need to run, coordinate, find the wind, adjust the strings, and learn to fly.

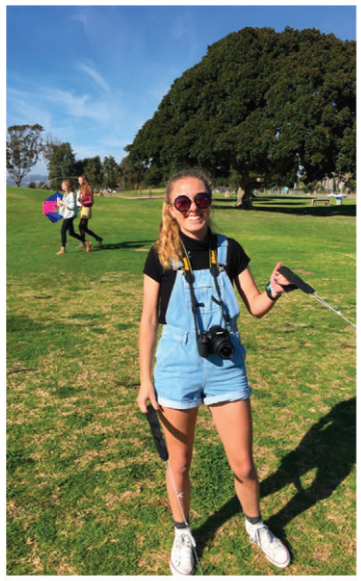
They took their journals into physics class and created a poster explaining what they learned. Then they brought it to art class for fine art help.

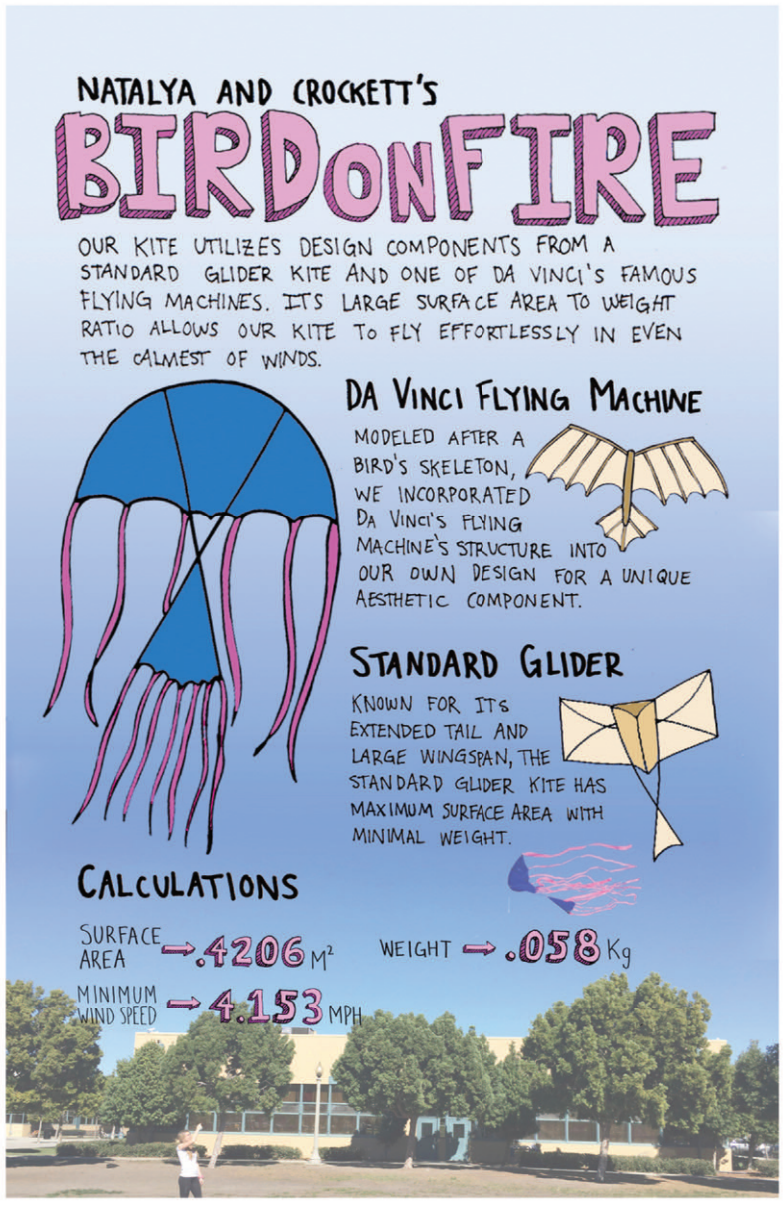
The students added onto and modified their kites with more dollar kites and other supplies, crafting a "Frankenkite." This step allowed them to experiment while they were learning in their physics class about the lift equation and the optimum angle of attack to generate the maximum lift. In art class they were also learning how to sew, design, and build—everything recorded in their composition books, with beautiful notes.

Each team then created their own original kite from ripstop nylon and carbon fiber rods and made a poster that explained their creation. One group made a six-foot-high triangular kite from Starbucks straws and crepe paper.'

The original kites were tested and refined. Each team presented to the class and the community. San Diego has a kite-flying park where serious kite builders make and fly kites; the students fit right in.







CHEETO CHASE

Becca, Greta, Jonathan

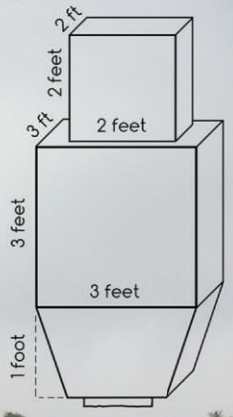
The large volume and geometrically sound design of the Cheeto allow for a smooth and graceful ascent.

MASS: 139 grams

VOLUME: 1,076.04 litres

TEMPERATURE:

95.304 °F - the air inside the balloon must be this much hotter than the outside temperature for flight.



Despite our tireless chase, the Cheeto ended up on a nearby rooftop, never to fly again.

Fly A Balloon With Us!

Our soda-can shaped balloon was inspired by our art teacher's love of Diet Coke.

The balloon was carefully constructed out of tisue paper. The "Diet Coke" logo was traced using a light projector.

Our Balloon:

The minimum temperature increase is the minimum temperature inside our balloon needed for lift.

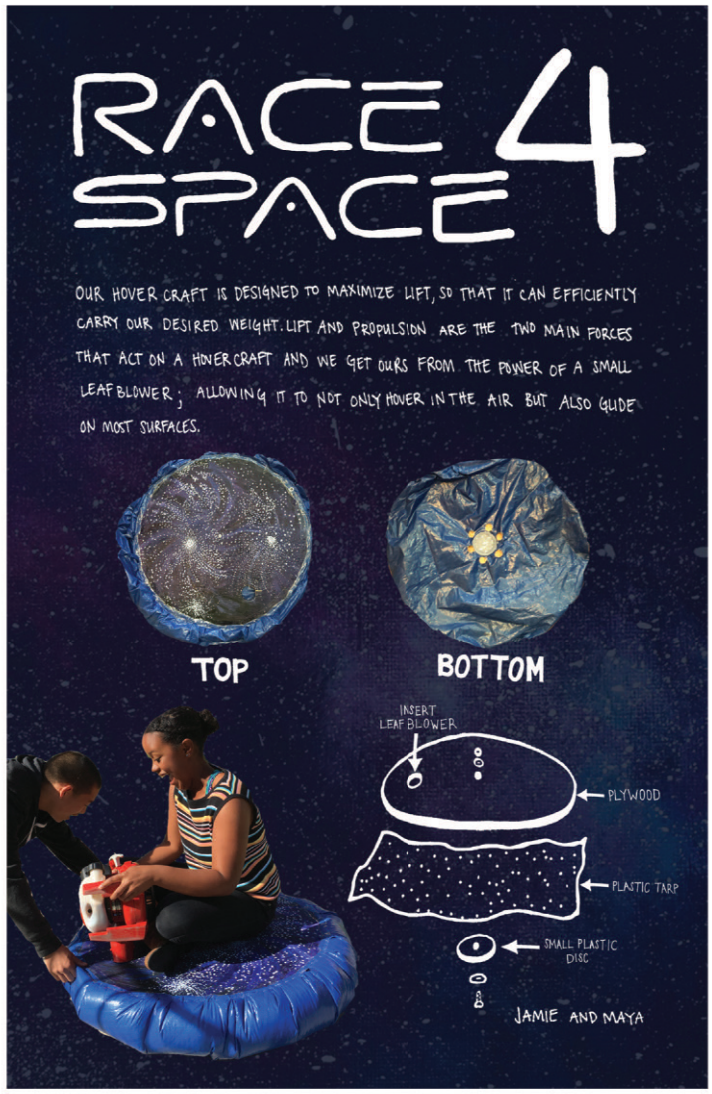
Min. Temp. Increase: 88 ° C
Volume: 20.58 L
Weight: 53 grams
Density: 17.6 g/L

BALLOONS
(next five weeks)

At 7:30 am, the whole class went to the Fiesta Island model rocket launch site, and with 50 Chinese lanterns purchased on Amazon for $1.50 each, they filled the sky. This introductory activity on a cold morning re-energized the group, as all at once the students lit the wax heat source and held their balloons till they all floated away. They continued to write in their journals about what it took to launch the balloons and what they would make next.

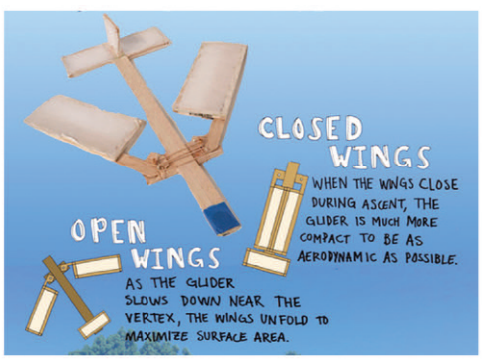
In teams, they created hot air balloons from tissue paper in different sizes and shapes, designed for beauty, humor, and lift. They documented and refined these balloons in class with the help of the teacher and each other. They were always negotiating with the laws of physics and the capability of their craftsmanship. Each day a barbecue was lit, the balloons tested, and hotdogs and hamburgers served. A semi-final exhibition for the crepe paper balloons documented what worked and what did not.

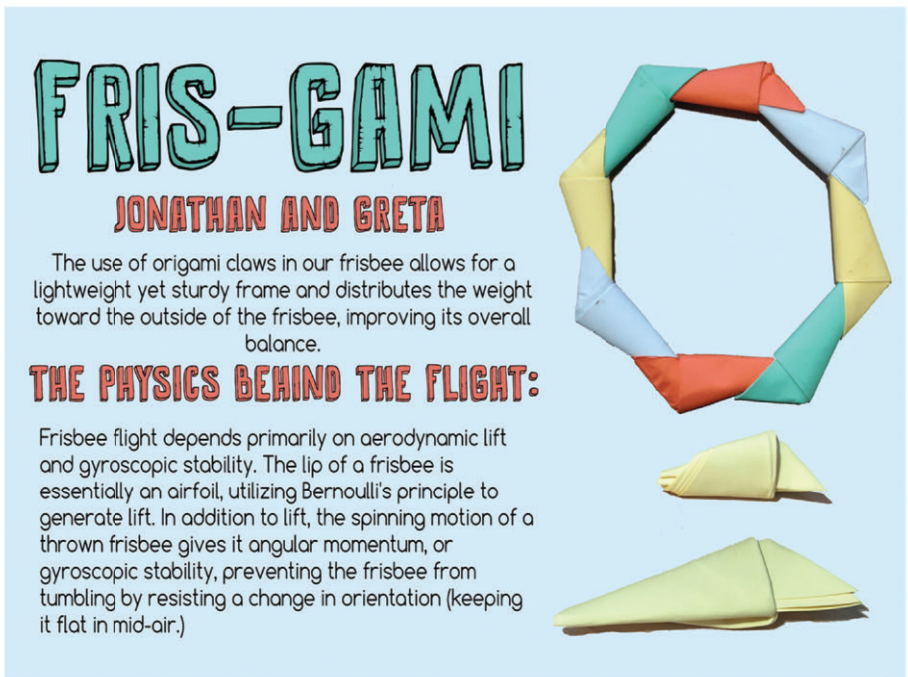
The final balloons were made of nylon and other materials that the students tested. The balloon exhibition was colorful and exciting; however, many balloons were never seen again.



FLYING OBJECTS
(final four weeks)

In teams, students made a flying object from what they had learned in physics and art classes, using wind, heated air, and/or gases. Some students used motors and slingshots. They created a poster explaining their flying object. There was a strict requirement that objects would need to fly for 100 yards to be considered successful.





LEARNING GOALS

- To understand the physics required to fight gravity
- To create a notebook of physics, art, observations, and wonder
- To have fun in physics and art class: "Not everyone loves both or either, especially during the second semester of 12th grade."
- To create beautiful physics projects
- To learn to sew and design flying objects
- To understand lift, wind, weight, force, air, and the physics behind these concepts

ASSESSMENT

Students' documentation and their products were used for assessment. Students had to meet deadlines, attend weekly check-ins, and participate in class discussions. They were evaluated on their notes, posters, collaboration, and if they had finished their work for the exhibition.

SCAFFOLDING AND DIFFERENTIATION

Each step and activity built intuitive knowledge about gravity. The students' documented their observations, created, tested, and expressed what they learned. The structure allowed for differentiation, as each student created their own products, within parameters. The project met the students at their level, letting them use their own vernacular to explain what they noted and connected to their creations. Later they learned the physics language and equations to explain what they had learned intuitively through flying or failing to fly their objects. According to Jeff, "some students who were not strong in math and physics happened to be the best sewers and were able to teach the physics wiz kids, and vice versa. It was a genuinely democratic project because everyone had to fight the same gravity."

Student-created poster for local store, "Sew Hut," which donated sewing machines and knowhow

"We were literally seeing mice run across our floors during our morning meetings." High Tech High's brand new building in Chula Vista was surrounded by open fields in an undeveloped area that had been gifted by the city. An unforeseen consequence was an endless stream of field mice besieging the school from the open terrain surrounding the building. In Jeffrey Govoni's fifth grade classrooms, the students were ready to go to war. But how could they remove the mice without trapping and killing them? According to Jeff, "this was one of those projects that had an in-the-moment authentic purpose that project-based teachers dream about."

After researching the rodents' local predators and carefully considering the impact each might have on the school environment, students ultimately decided that owls would be the safest and most effective choice to naturally reduce the rodent population. The students really wanted to bring in stray cats and give them homes around the school, but discussion and debate led them to decide that feeding and caring for the cats would become too difficult. Snakes were also a popular idea until one of the students mentioned that her brother, in kindergarten, was terrified of snakes. The only two local predators left to debate were hawks and owls. It was during the research of these two predators that one of the students discovered the existence of owl boxes.

LEARNING GOALS

- To understand natural predators and ecological balance
- To develop math skills for design and building: fractions, calculation of area, and perimeter
- To develop persuasive writing, revision, and critique skills
- To understand and practice the design/build process, including planning, budgeting, prototyping, revision, and final building

All of the students researched, designed, and built their own unique owl houses. The special features of these shelters allow owls to safely multiply without their eggs being raided by hawks. Each team of students created three separate prototypes: One, at a smaller scale made of poster board, which they used to refine their blueprints. Then, one at full scale using cardboard. Finally, they designed, built, and stained their final products, which were made of high-grade plywood and based on their own unique blueprints. Student research revealed that the owl boxes could be any shape so long as each box had the specific features that saved the eggs from hawk attacks.

Students also created slide decks to present their research and wrote persuasive letters to project backers that successfully raised more than half of the funding necessary for materials.

ASSESSMENT

Jeff was "thrilled and surprised at the variety of skills this project touched." In math, students used measurement, conversion, fractions, mixed numbers, area, perimeter, and made two-dimensional nets that folded into three-dimensional products. In writing, research-based persuasive letters to raise funds revealed the students' deep knowledge of local predators as well as the owl boxes themselves. Along the way, there were many opportunities for assessment, including plans, scale models, multiple drafts of persuasive essays and letters, and slide deck presentations.

EXHIBITION

An exhibition for family and community members was held, showing off the final products as well as the process. But the real impact was felt a few months later, when owls came to nest in the boxes, and the rodent problem was solved.

RAPTORS FOR RODENTS
JEFFREY GOVONI • FIFTH GRADE
HIGH TECH ELEMENTARY CHULA VISTA

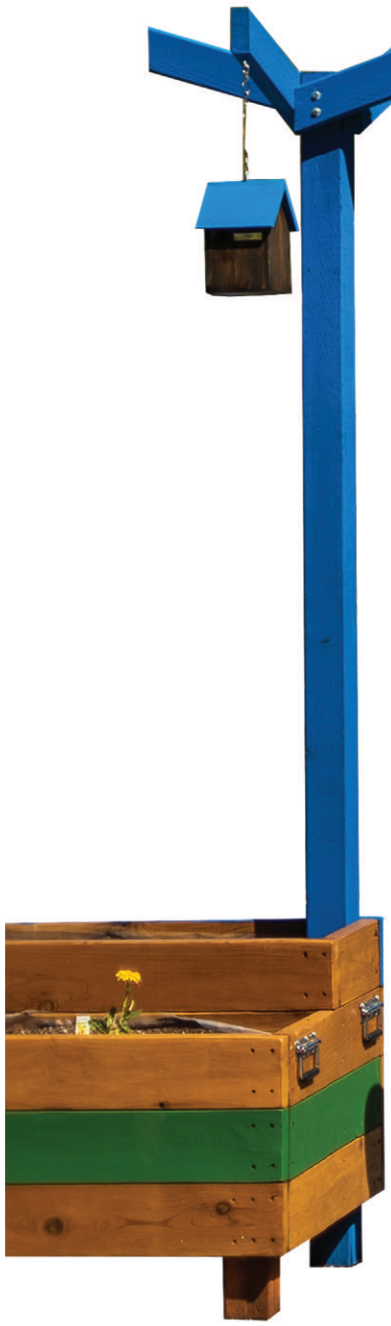
“A real client makes all the difference.”

Pat Holder and John Santos teach humanities and environmental science, respectively, and they are also both woodworkers and passionate about teaching students to design and build. They were planning to collaborate on a project about nutrition, agriculture, and food access when the director of a sister elementary school approached them. The elementary school had a large blacktop play yard and needed a way to create a separate area for kindergarteners. With an authentic need and a real client, Planting Community took shape.

During morning academic classes, students read about and researched issues related to agriculture and food production. They looked at food choices; what adults and kids choose to eat; how those products are farmed or produced; and what the impact of those choices are on humans and on the environment.

In John’s class, students learned about plant biology, environmental systems, and disruptions to those systems. Students wrote three rounds of research articles, choosing their own topic for each round. The first round focussed on broad, global environmental issues (this was to get them better at research and writing), and the second article looked at environmental issues related to feeding the global community. The final round (once they had improved in research and writing) was to write an article specific to the environmental issues and impacts of feeding the San Diego community, including interviewing an expert.

To dive even deeper, students chose a specific food product and traced all of its impact, from nutrition to packaging, to how it is produced, to the impact on the environment and the workers in that sector. They wrote articles, conducted interviews with experts, and created a poster with their findings.



PLANTING COMMUNITY

HUMANITIES • ENVIRONMENTAL SCIENCE

ELEVENTH GRADE

PAT HOLDER • JOHN SANTOS • HIGH TECH HIGH

In parallel, students were also engaged in designing and building. John and Pat wanted to scaffold the design/build process so that students could learn to use the tools and materials before they engaged in the high stakes products for a real client. First they built small planters as a mini-project. Next they did a "marketplace build;" a product of their choice that had something to do with food or agriculture. These were sold at an exhibition to raise funds for the final elementary school installation.

Meanwhile, students were meeting with the kindergarten teachers and children to understand their needs and desires. They went through iterative stages of creating models and getting client feedback. Finally, they were ready to build. Students worked in groups to create large mobile planters for the kindergartens that featured seating, storage, learning spaces, manipulatives, bird houses, and gardens.

LEARNING GOALS

- To understand the impact of food choices and the food industry on humans and the environment
- To understand plant biology, biodiversity, environmental systems, and how disruptions to systems cause environmental issues
- To develop a stronger ability to research and synthesize information from external published sources, and to interview experts effectively
- To develop planning, collaboration, and communication skills
- To strengthen revision/critique skills and develop an ethic of excellence
- To understand the complexities of the design process when working with the constraints of a real client's needs, financial limitations, and material constraints
- To strengthen choice and ownership. (This goal often goes unspoken, but is very important to John and Pat—each cycle of the project challenged students to find topics they were interested in, choose a group to participate in, and voice their opinion in design choices.)

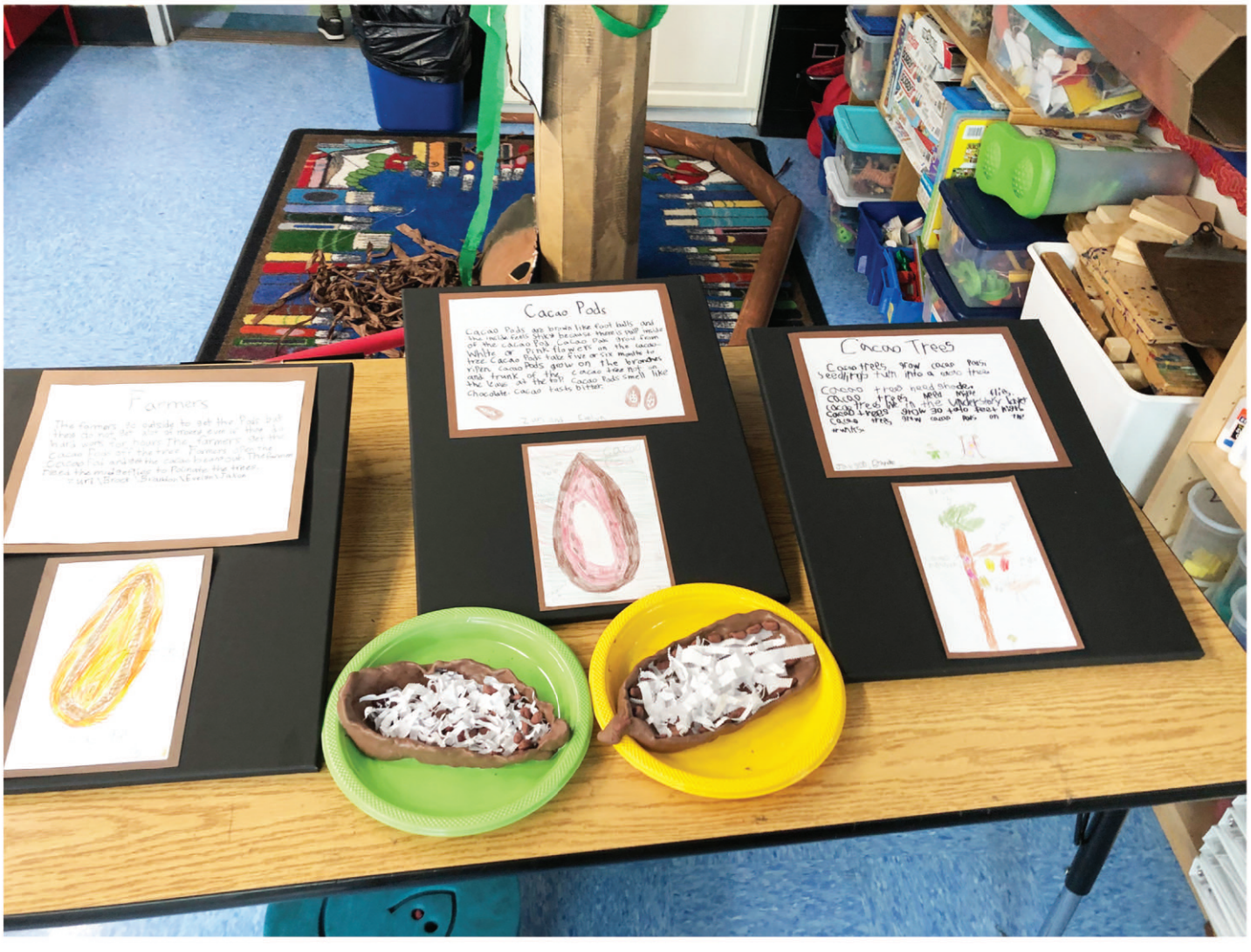
EXHIBITION AND ASSESSMENT

A first exhibition featured a market of smaller food-related products and raised funds for the final planters. The final exhibition featured the planters and the food product research essays and posters. The true proof of concept occurred when the planters were installed in the elementary school playground, filled with plants, and tested by kindergarteners.

John and Pat continuously checked in with students about their progress, and the various products they were creating. They also created multiple opportunities for critique throughout the project—on built products, designs, writing, and presentations. Students' grades derived from an assessment of participation, process (time management, collaboration, planning), and product.

Starting with something that almost every first grader loves, chocolate,

led to investigations of rainforests, ecosystems, agriculture, history, the economics of trade, and cooking. When Linda Salamanca, Diane Hawke, and Jen Schultz first began this project, they knew the children would be very excited about making chocolate and learning about the rainforest and the animals that lived there. The students were amazed at how much time and effort goes into making chocolate while exploring the harvesting and manufacturing process. But what surprised the team most was "that first graders could understand the impact of the environmental effects and social injustices of chocolate harvesting and that they would become so passionate about making change and teaching others."



THE CHOCOLATE PROJECT

HIGH TECH ELEMENTARY EXPLORER

DIANE HAWKE • LINDA SALAMANCA • JEN SCHULTZ • JULIE HUTCHINS

FIRST GRADE

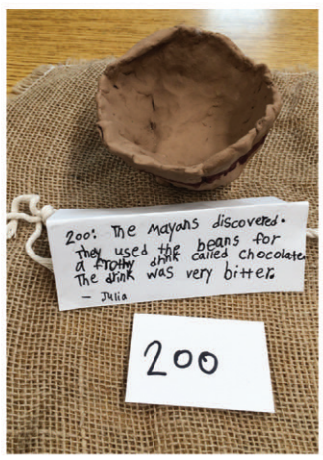
LEARNING GOALS

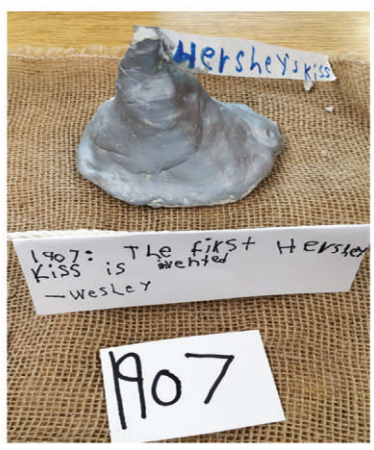
- To understand how cacao is cultivated, manufactured, and sold
- To learn about the history of chocolate
- To learn about the rainforest ecosystem in which cacao trees grow, and the impact of the cacao industry on it
- To develop writing, editing, critique, and revision skills
- To learn about who produces chocolate and how it affects their life

First grade chocolatiers worked in groups to undertake research projects based on their chocolate-y interests. Some created models of cacao pods, trees, and their ecosystems, others studied the harvesting and manufacturing of chocolate. Some created a map to show where cacao grows in the world and others demonstrated how cacao's use has changed over time. Every group completed cycles of critique and revision to create a product that demonstrated their learning. In addition, the students examined the environmental impact of cacao farming and the social justice issues around underpaid farmers and child labor. The students created a PSA to encourage people to purchase only fair trade and sustainably farmed chocolate.

The science teacher, Julie Hutchins, collaborated closely with the team. In their science exploratory, students built a rainforest biome, created a web of interconnected rainforest species, investigated the life cycle of midges, dissected cacao pods to learn about their various parts, and experimented with recipes.

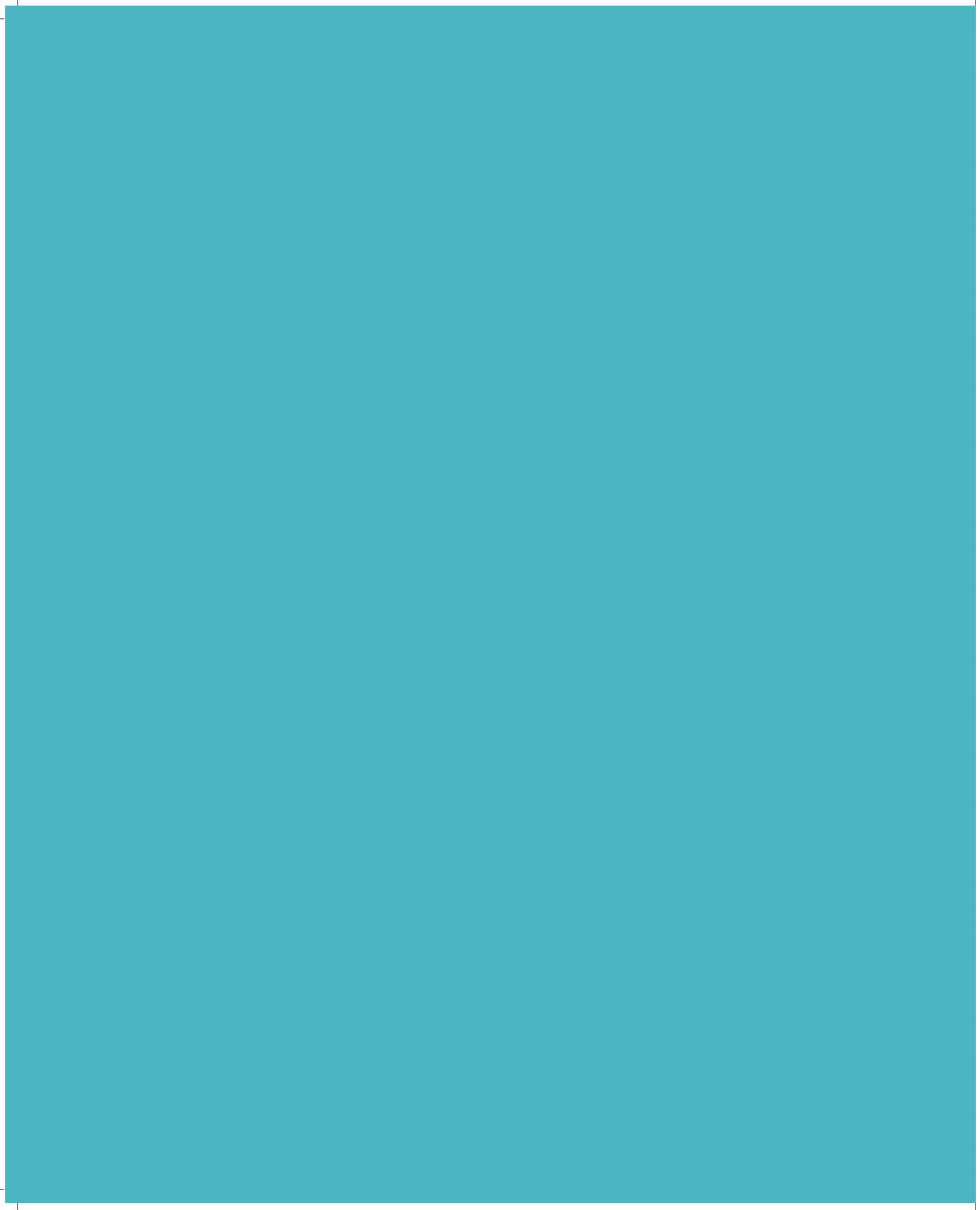
Throughout the project, students looked forward to the final week's event—making chocolate. Students worked in tasting and design groups to devise their own chocolate recipes. The best recipes were produced in greater quantities and sold at the exhibition chocolate store.





EXHIBITION

Students created a chocolate museum, with areas dedicated to the history and manufacturing of chocolate, models of cacao harvesting, the steps in chocolate production, and maps of where chocolate is grown and traded. Another section of the museum recreated the rainforest ecosystem, with paper mache animals and written explanations of the relationships between species. The final (and most popular) section of the exhibit was the chocolate store, where student-made chocolate varieties were sold to families and the school community. Funds raised from chocolate sales were donated to non-profit organizations working to promote rainforest preservation and fair trade.



IN THE WORLD, WITH THE WORLD

In these projects, students are understanding the need for change in their world and making that change, through service or community action.

VERSUS

XONR8

URBAN ANT PROJECT

DOES MY VOTE MATTER?

GROWING BEYOND EARTH

OPERATION STORY CUSHION

BEYOND THE CROSSFIRE

THE BACKYARD ECOSYSTEM PROJECT

THE VOICELESS

MEDIA SAVES THE BEACH

VOICES AND VISIONS

STORYTELLERS OF THE LAND

LOGS OF THE SAN DIEGO BAY

CHEMISTRY & CONFLICT

THE BEE PROJECT

VOICES OF JUSTICE

STARS IN THE PARKS

THE TRUTH ABOUT FOOD

MAD PROPS PODCAST PROJECT

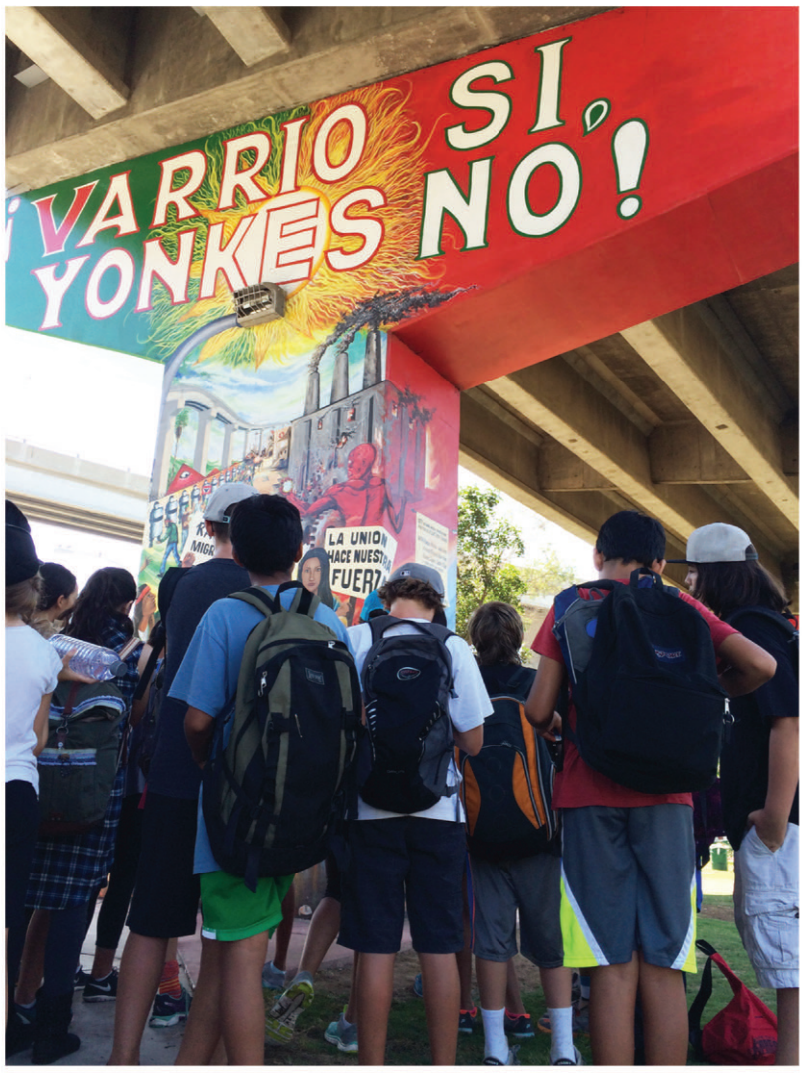
What is a dichotomy?

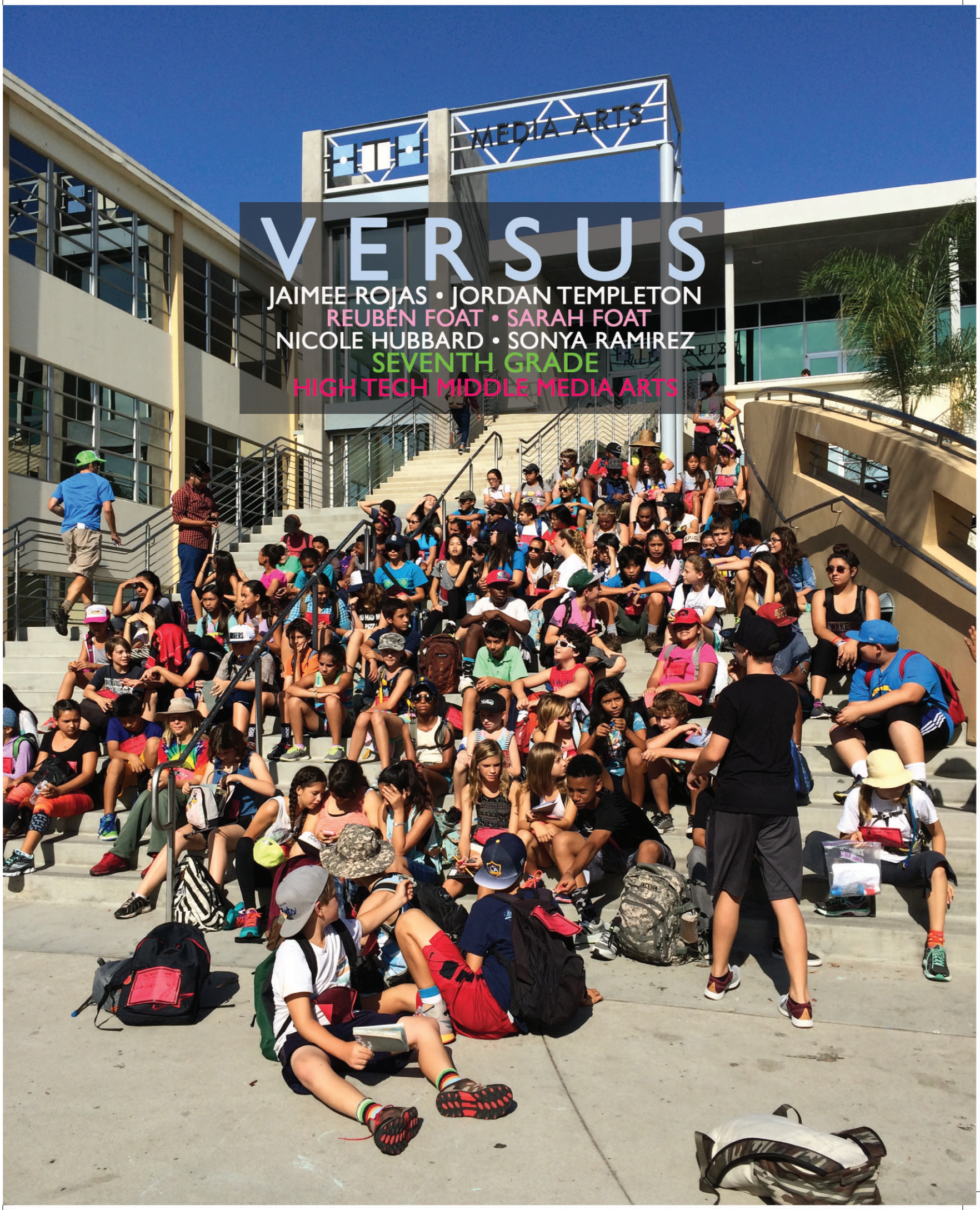
What dichotomies do we see around us? How do maps convey meaning and perspective? These were among the many interdisciplinary questions considered by seventh graders in this project that examined the social and physical landscape of their city, San Diego.

The central idea of this project was to use the city itself as a text, specifically, a three-day, 23-mile journey on foot from the Mexican border to the Cabrillo National Monument very close to the school (where the explorers/conquistadors first landed in California).

Students captured the details of the journey through photography and journaling, later to be synthesized into a book focused on dichotomies that students chose to highlight.

To add to their reflections on the journey, students interviewed community members and organizations to explore the dichotomies in their lives.





VERSUS

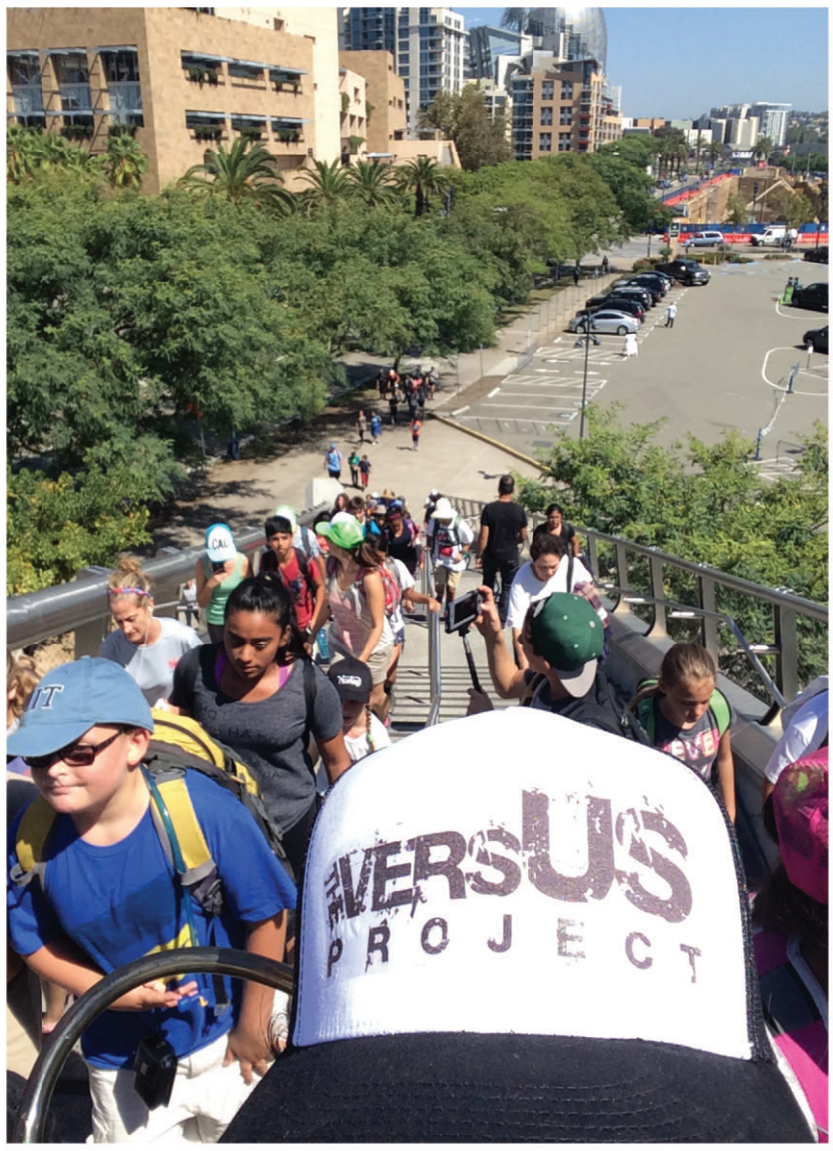
JAIMEE ROJAS • JORDAN TEMPLETON
REUBEN FOAT • SARAH FOAT
NICOLE HUBBARD • SONYA RAMIREZ
SEVENTH GRADE
HIGH TECH MIDDLE MEDIA ARTS

LEARNING GOALS

- To develop skills of close observation, documentation, and reflection
- To learn how universal themes or dichotomies show themselves locally
- To develop non-fiction reading and writing skills
- To learn about ratios, scale representation, area, and solving for unknowns using proportional relationships
- To learn about and develop skills in cartography, 3D vs. 2D representation, and distortion in maps

The teachers planned for the walking journey itself to take place in the middle of the project, around the fifth week. Leading up to the three-day event, students researched themes or dichotomies they might want to focus on through readings, visits to community organizations, and visits from guest speakers. During the weeks after the walk, students culled through journals, photography, and observations to create books on particular themes. For example, one book, entitled *Surviving and Thriving,* focused on wealth and poverty among different communities and displayed graphic representations of demographic and income data in neighborhoods that make up the San Diego region. Another focused on high crime vs. low crime neighborhoods.

Students worked in groups to create books on the themes they had chosen. Each book contained original writing, photography, and graphic representations of data gathered. In order to pull all these pieces into a final product, each group member had a specific role, including managing editor, map guru, art director, and hunter-gatherer (research director).



MAKING THE MAP

At the same time, the team was also investigating cartography and topographical maps, and how various kinds of maps can convey meaning or distort reality. In their Makers class, small teams each took on a segment of the San Diego map, and created a giant laser cut map of the city.

Students created this 3D installation using information found on free topographic maps made by the United States Geological Survey (USGS). They used this information to create a file in 3D modeling software (Rhino 3D) which in turn was read by a computer-controlled laser cutter to engrave and cut thin plywood. Working in groups of 3 to 5 students per square, they used small spring clamps and glue to physically assemble the pieces together. Students needed to learn how to read the real USGS maps in order to assemble their wooden one correctly, which took considerable time and skill.

SCAFFOLDING AND DIFFERENTIATION

Accessibility was an important building block of this project from the start. The concept of grounding it in students' own close observations of the city during the walk, and enabling every group to choose their own theme made it open to all levels of academic preparedness. The education specialist for the grade joined in the summer planning, and the whole team walked a portion of the journey to anticipate the students' experience. Thinking maps and individual support for making claims and backing them up with evidence helped to scaffold the writing in the project.

EXHIBITION AND ASSESSMENT

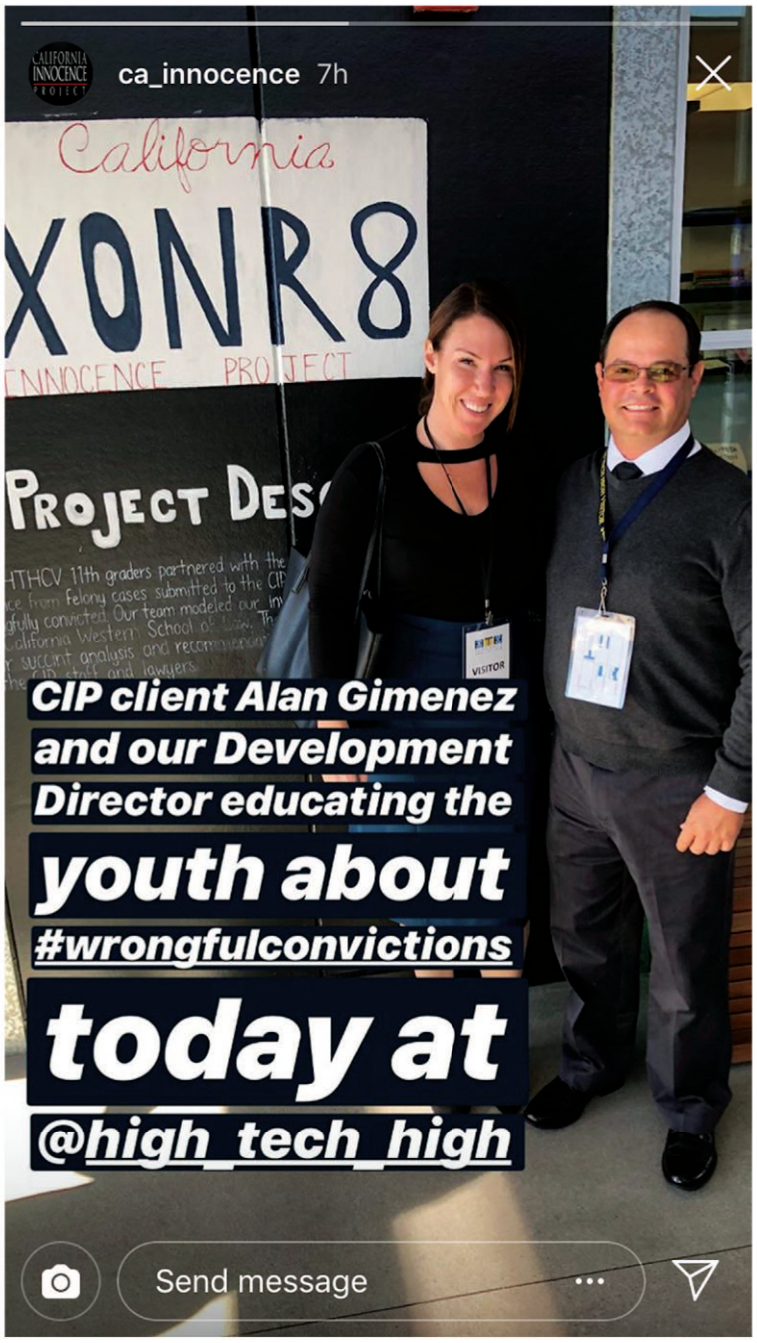
The exhibition took place at the San Diego History Museum, where the topographical map was installed and on display for several weeks. On the day of the exhibition, students also displayed their books, and documentation of their process, including the long journey.

The teaching team used a form of self-assessment adapted from Ron Berger's *Leaders of Their Own Learning*. Students reflected on and assessed their own learning on specific learning targets in humanities, math, and collaboration, leadership, and perseverance. Teachers offered their own assessments in a written dialogue with each student.

“Can we work on actual cases?”

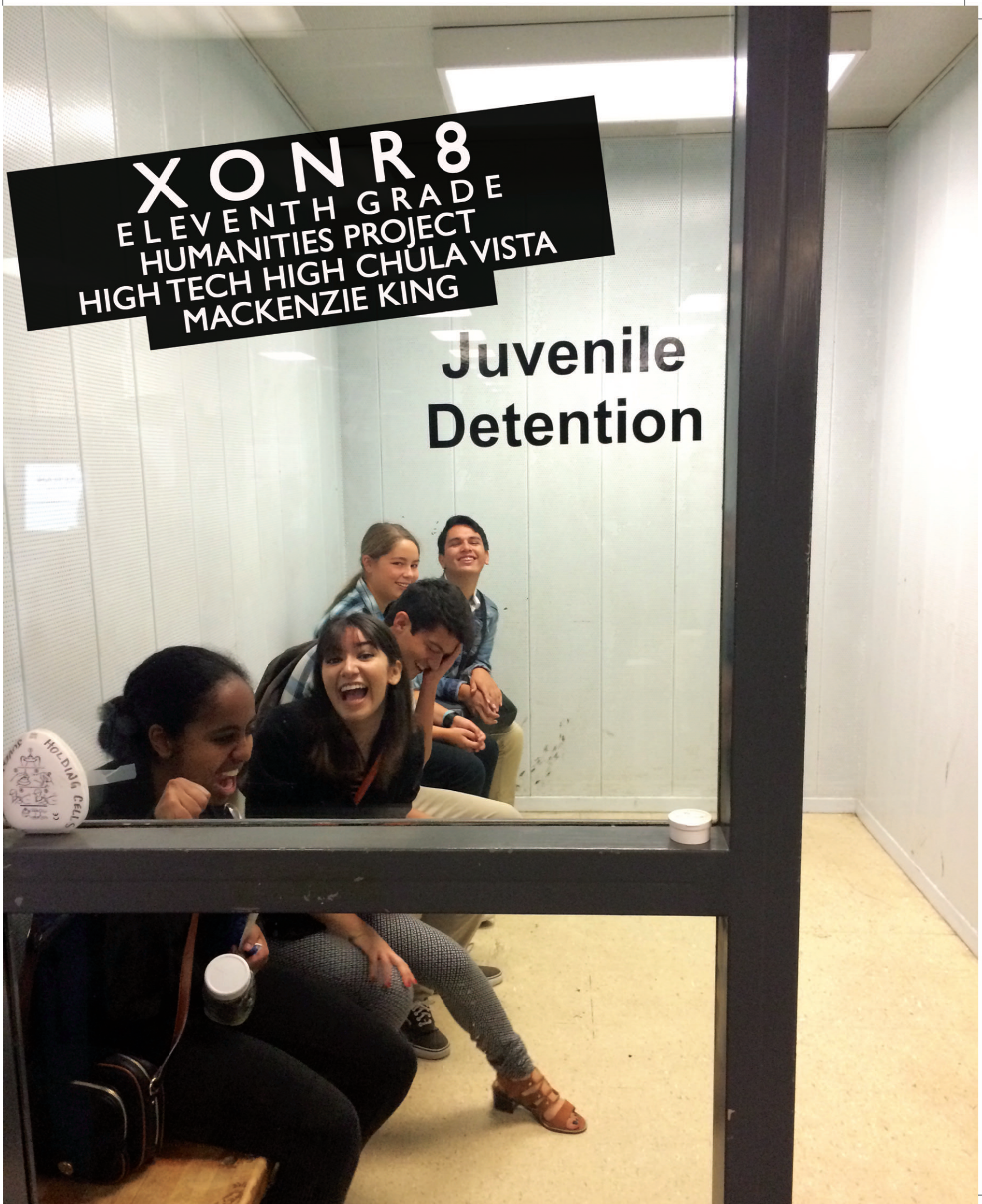
Mackenzie King wanted to design a project that critically examined the criminal justice system in the United States. Through a colleague, she got connected to the California Innocence Project (CIP), an organization that takes on cases of wrongfully convicted prisoners. Based on past experiences with community partners, Mackenzie was worried that they might not “trust the students to do anything meaningful.” So she put her cards on the table, asking from the outset, “Can we work on actual cases? To my astonishment, my daily astonishment, they said yes and continue to say yes.” Part of the reason, Mackenzie explains, is that CIP gets thousands of requests from incarcerated individuals every year, and relies on pro-bono lawyers or law school interns to screen them. They need the help.

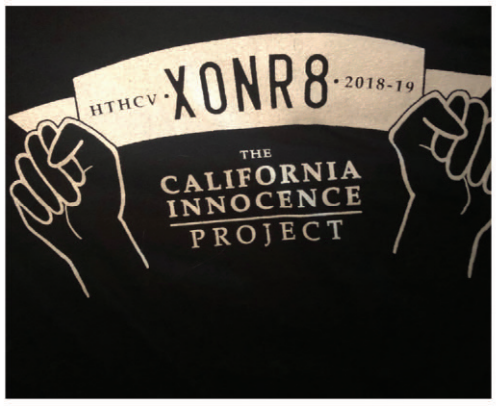
The project engages groups of students in reading and analyzing actual clients’ case files (one case per group), and coming up with a recommendation to CIP about whether they should take on the case or not, based on the possibility of the clients’ innocence, and the availability of evidence that could prove it. Each case file includes many documents, including legal and technical language with which the students are unfamiliar. After analyzing the case files, students created a memo detailing their recommendations, and presented to CIP lawyers and law students. (This product and process is modeled on what CIP asks of its volunteer lawyers and law school interns.)



XONR8

ELEVENTH GRADE
HUMANITIES PROJECT
HIGH TECH HIGH CHULA VISTA
MACKENZIE KING





LEARNING GOALS

- To formulate and support an argument with evidence
- To understand why people are wrongfully convicted
- To investigate who is wrongly convicted
- To understand why it is difficult to exonerate the wrongfully convicted
- To explore whether the U.S. criminal justice system is just

To scaffold the challenge of close technical reading, Mackenzie first assigned students an autopsy report to read, minus the final cause of death. Their job was to read this very technical document, looking up any terms they did not understand, and see if their conclusion matched that of the medical examiner.

Then the class worked through one CIP client's file as a whole group, exposing the students for the first time to the various possible documents in such a file–appeal letters, summary of court testimony, police reports–and the kind of vocabulary and close reading that would be required.

Finally the students were assigned their own case. Mackenzie used a randomizer to create groups initially, and then fine tuned the groups to balance them based on reading levels, special needs, and group dynamics. Students read closely and summarized all of their case documents. Once they came to a recommendation, they worked on multiple drafts of their final memo. Students practiced their presentations in front of other student groups, which enabled them to anticipate questions and weaknesses in their argument.

At the same time, students read *Just Mercy* by Bryan Stevenson and *The New Jim Crow* by Michelle Alexander. The texts provided students with a background on the inequitable history of the criminal justice system in the U.S., as well as an emotional connection with the wrongfully convicted persons featured in these books.

SCAFFOLDING AND DIFFERENTIATION

According to Mackenzie, this project "can be very tough for a struggling reader." But the real world nature of it motivated the students to persevere. Due to the technical nature of the reading, all students were chunking documents into small parts and reading very closely, relying on group conversations, and looking up words to help them understand. Whenever possible Mackenzie supported students in visualizing events and information from the documents, such as creating relationship and family trees, timelines, mapping out crime scenes, and utilizing Google maps.

EXHIBITION AND ASSESSMENT

The memo to CIP and the presentation to staff and lawyers comprised the most authentic form of assessment possible. A momentous decision —whether or not their case would be taken on—depended upon the quality of students' thinking, writing, and presentation. Nothing could be more motivating. As one student remarked, "What I will remember the most about XONR8 is that we had the ability to change people's lives."

The collaboration with the California Innocence Project has grown. In subsequent years, Mackenzie has added new elements to the project, and other HTH teachers have initiated similar projects with their students.

San Diego is a biodiversity hotspot,

with thousands of different species of plants and animals. This includes several hundred species of ants, each of which plays a unique role in the ecosystem. The introduction of the invasive Argentine Ant disrupted local habitats and is therefore of great interest to scientists.

Students in kinder, third grade, sixth grade, and high school collaborated with researchers at the University of California as part of the San Diego Urban Ant Project. This citizen science project is aimed at mapping the presence of the invasive Argentine Ant, which has been responsible for the decline and absence of native ants.

As citizen scientists, students participated in the scientific process through data collection, data analysis, and communication of findings. This unique opportunity to contribute to a long-term ecological research study provided a real world context for students to learn the science of living things and their interdependence on each other and the environment.

Students investigated ants in their urban and natural environments. From schoolyards, backyards, and neighborhood parks to local natural reserves and protected areas, students assessed and reported their findings to university and community partners to further understand the impacts of invasive species on local ecosystems. They created art and published work in various formats to explain insects, biodiversity, and local ant species phenomena.

Myrmecocystus

Honeypot Ant

Anatomy

Personality

- Workers: They are hard working.
- Slaves: They let other ants boss them around.
- Kind: They let ants store food in them.

Quick Stats

Ant Color: Yellow/orange head with a dark brown body. They can also be all gold or all black.

Ant Size: Medium: ½ of an inch.

Physical Characteristics:Medium: ½ of an inch.

Habitat & Region: This ant species is found in western North America. (California, Nevada, New Mexico, Mexico, and Oregon.)

Interesting Facts

- Honey pot ants touch antennae to communicate.
- In the ant's large abdomen, they store "honey".
- The "honey" stored in their abdomen, isn't actual honey, it's actually natural sugars that it sucks up from nature.
- The Honeypot ant's abdomen enlarges as it sucks up sugars through their mouths and it goes into their gaster.

URBAN ANT PROJECT

KINDERGARTEN • THIRD GRADE • SIXTH GRADE • ELEVENTH GRADE

STEPHANIE LANCE • SHELLEY GLENN LEE • MATT LEADER
ANDREA FRIAS • KRISTIN KOMATSUBARA

LEARNING GOALS FOR KINDERGARTEN

- Explore what science is and what scientists do
- Learn about arthropods from a variety of habitats
- Learn interviewing skills through face-to-face meetings with experts
- Learn math, counting, and graphing skills
- Experience scientific field observation and journal-keeping
- Develop writing, critique, revision, and collaboration skills
- Develop supported research skills while creating scientific sketches of animals

LEARNING GOALS FOR THIRD GRADE

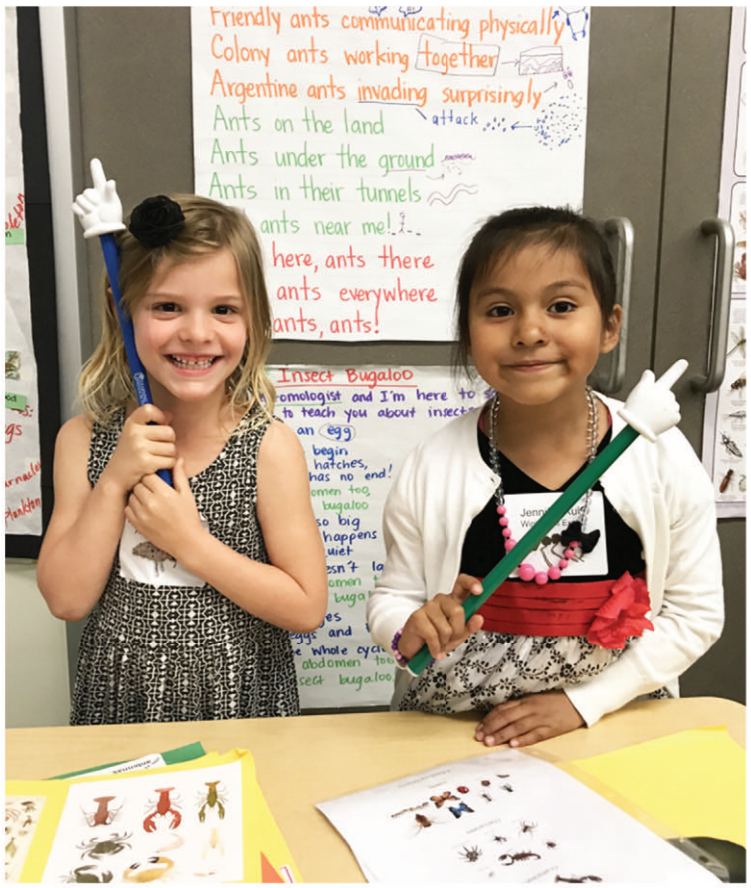
- Develop data collection, analysis, and graphing skills
- Develop non-fiction reading skills and understand what makes effective non-fiction text
- Understand biodiversity and the role of native and invasive species
- Develop writing, critique, and revision skills
- Develop collaboration and presentation skills
- Produce informational text about 1 of 24 ant species and produce a scientific sketch

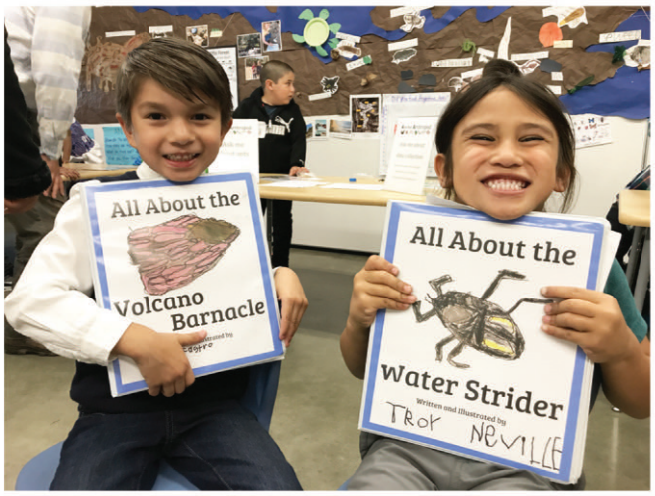
LEARNING GOALS FOR SIXTH GRADE

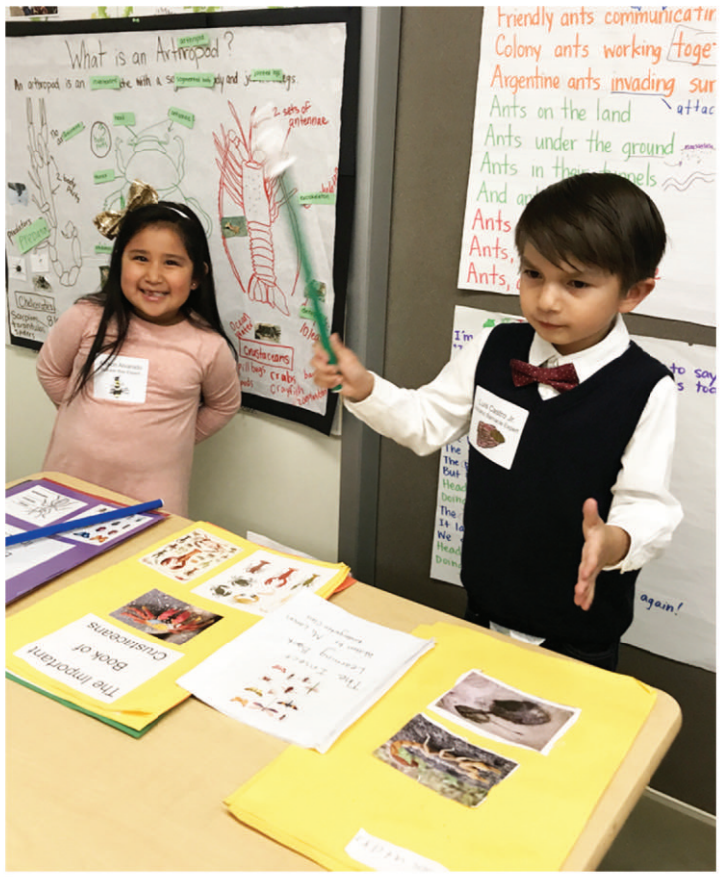
- Use critical observation to notice and wonder
- Explain how animal behavior and specialized structure affect the probability of survival and reproduction
- Collect, analyze, and interpret data to distinguish between causation and correlation
- Obtain, evaluate, and synthesize scientific information from multiple sources
- Write, critique, and revise *The San Diego Urban Ants Field Guide*

LEARNING GOALS FOR ELEVENTH GRADE

- Develop skills to utilize academic papers and first person accounts as source material
- Develop analysis of data using statistics to explain shifts in populations
- Evaluate evidence supporting claims that changes in environmental conditions may result in changes in the number of species
- Identify and refine solutions to reduce the impact of humans on natural systems
- Further develop scientific writing, critique, and revision skills





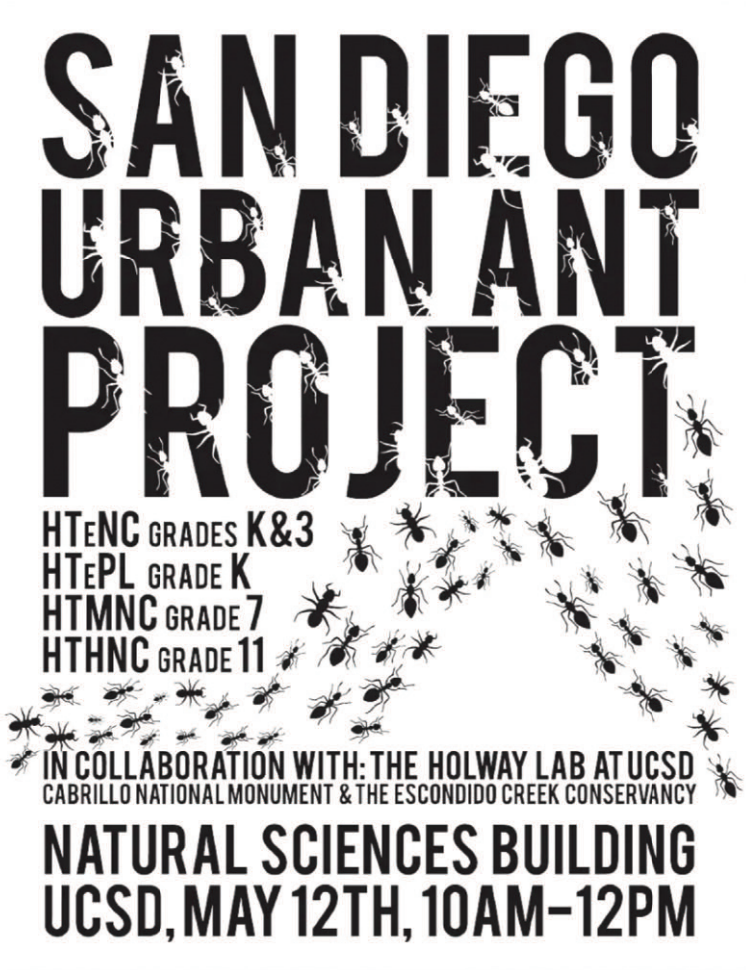


Students participated in multiple field studies to collect data on ants in various settings. Kindergarteners studied habitats and built model habitats as a mini-project. As a final project, kindergarteners created *All About* books about a particular insect and collaborated on an *A is for Arthropod* alphabet book. Third graders collaborated on a field guide covering local ant species. They also designed solutions to the invasive ant problem in San Diego.

Eleventh graders worked on a variety of products individually and in groups. A first mini-project was a personal statement about how they came to study Formicidae (ants): whether their focus was on biology, ecosystems, sociology and behavior, or another lens. The students conducted experiments and wrote a joint scientific paper analyzing the impact of irrigation on ant populations, and the invasive ant phenomena. They wrote "Antllegories," fictional works related to some aspect of ant behavior that intrigued them. They also created informational "ant farm" art pieces with laser cut wood, paint, and plexiglass to illustrate aspects of their research.

EXHIBITION AND ONGOING WORK

All grade levels participated in an exhibition at the university, which was attended by family members as well as academics and community experts. This collaborative project has evolved over several years and expanded to include teachers and students in other grades and campuses—each contributing data to the ongoing university research project. More detailed information can be found at: https://sdurbanantproject.weebly.com/



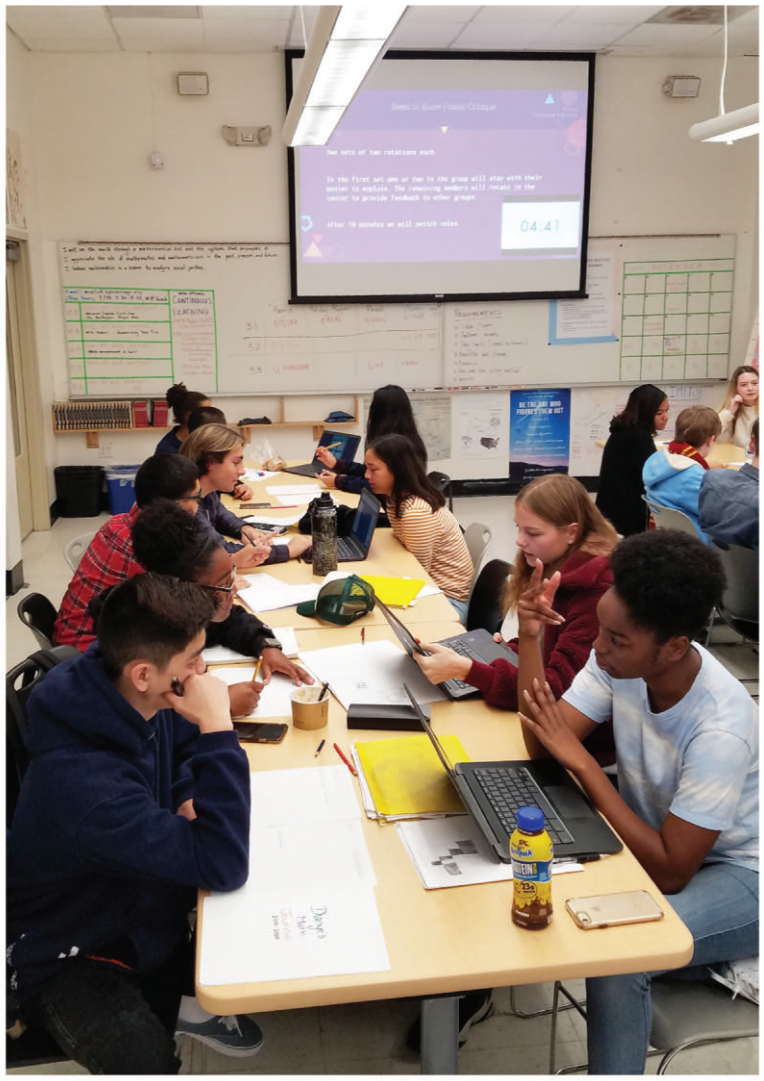
“Wait, what? That’s not fair!”

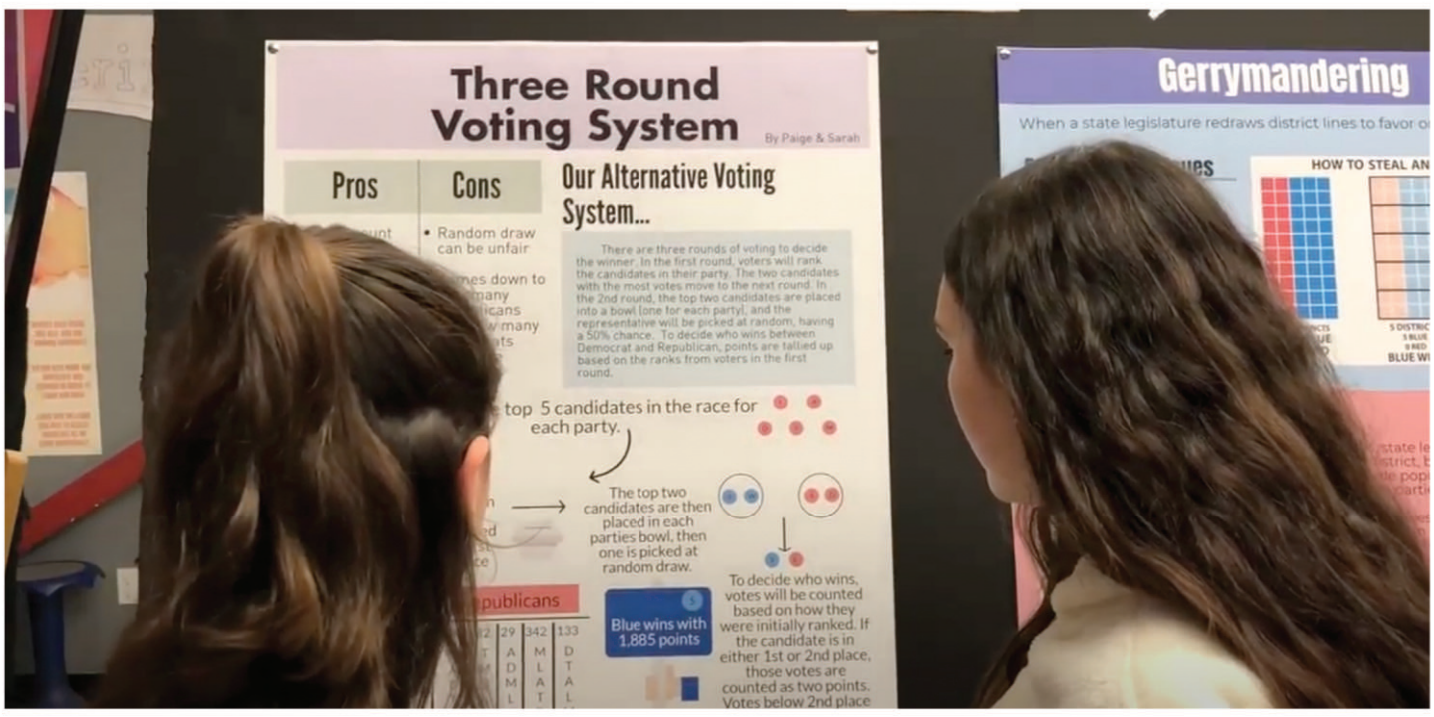
In their senior year, many students become eligible to vote for the first time. Some are excited, while many think there is no point. This project goes beyond issues and candidates to look at voting itself through a mathematical lense. Does My Vote Matter introduces students to the wide array of voting systems that exist and to various measures of fairness in those systems.

Mele Sato launched the project with a mock election in which students voted, and then tallied the votes using different systems—for example, one-person-one vote, an electoral college, a runoff election, a two-party election. The results showed that with the same votes, different voting systems generate different outcomes. “Wait, what? That’s not fair!”

Given most teenagers’ strong sense of justice, students were now motivated to examine what might seem like a dry topic—various systems of voting, and the mathematical methods of measuring the “fairness" of voting systems. Throughout the project, students asked themselves, “If current voting systems are unfair, what would a fairer system look like?”

One project deliverable was to create a poster illustrating a particular voting system that analyzed its benefits and drawbacks.



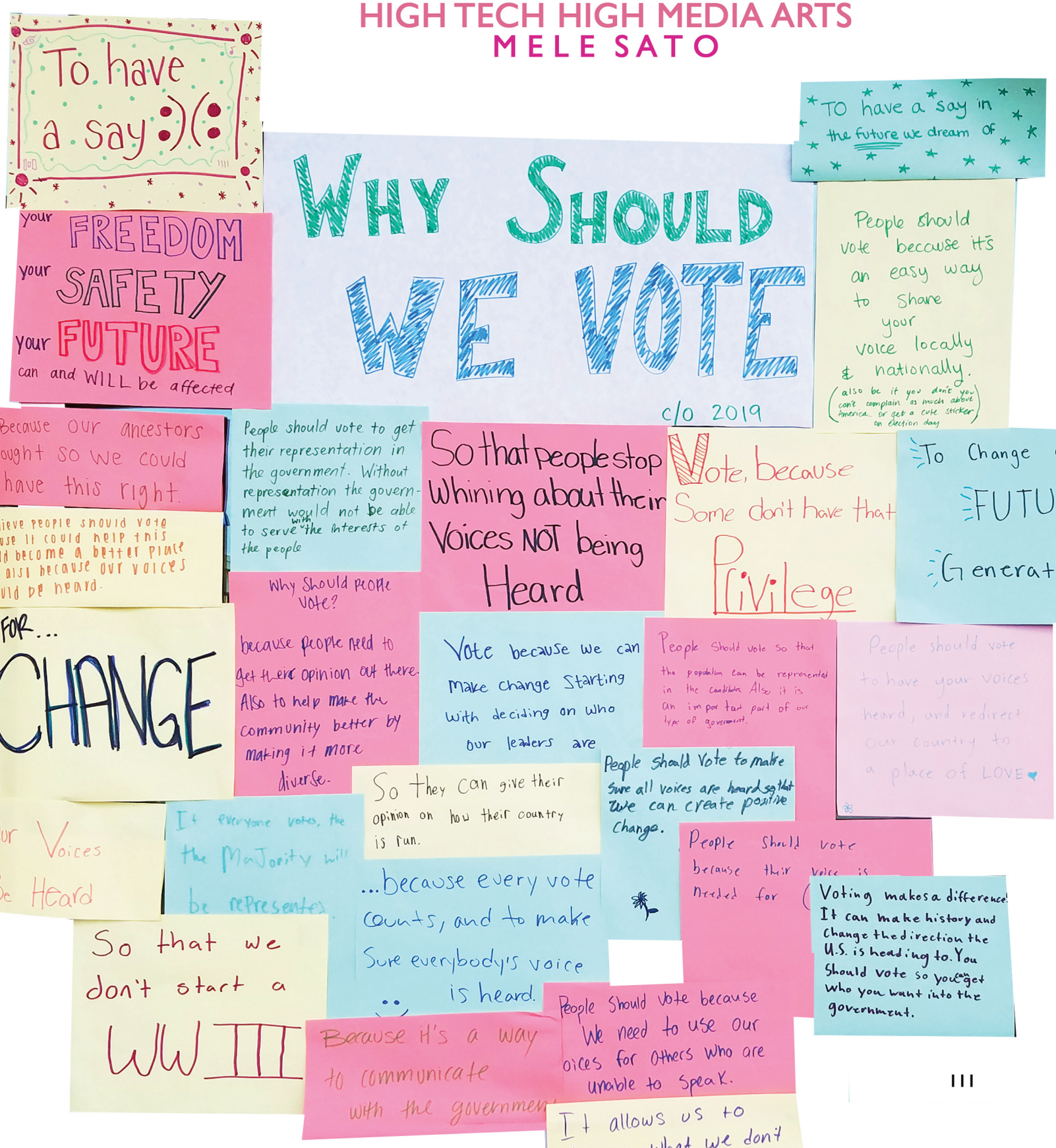


DOES MY VOTE MATTER?

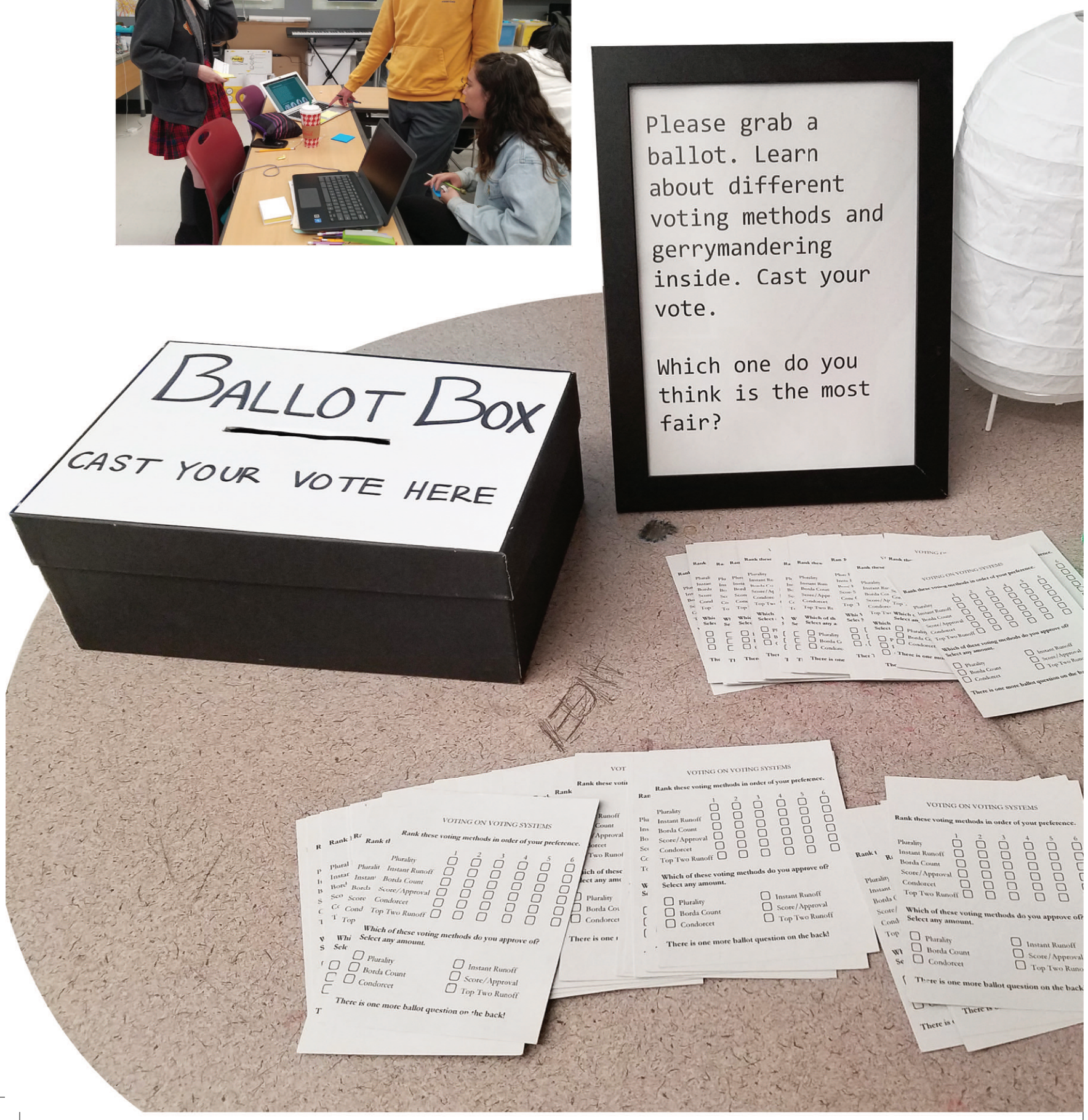
TWELFTH GRADE • MATH

HIGH TECH HIGH MEDIA ARTS

MELE SATO



SENIOR SEMINAR IN MATHEMATICS
BE THE ONE WHO FIGURES THEM OUT


BALLOT BOX
CAST YOUR VOTE HERE
Please grab a ballot. Learn about different voting methods and gerrymandering inside. Cast your vote.
Which one do you think is the most fair?
VOTING ON VOTING SYSTEMS
Rank these voting methods in order of your preference.
Plurality
Instant Runoff
Borda Count
Score/Approval
Condorcet
Top Two Runoff
1 2 3 4 5 6
Which of these voting methods do you approve of? Select any amount.
Plurality
Borda Count
Condorcet
Instant Runoff
Score/Approval
Top Two Runoff
There is one more ballot question on the back!

LEARNING GOALS

- To understand, evaluate, and explain various voting systems
- To understand and use various mathematical models that describe voting and choice
- To understand and use mathematical concepts that describe demographic data
- To understand voting theory, choice theory, group theory, and the ways that mathematicians and social scientists use math to describe, predict, and evaluate human behavior
- To understand the history of voting rights, redlining, and local school districting
- To propose a more fair voting system
- To propose a more fair congressional districting plan

In a second phase of the project, students analyzed the way their own voting districts are defined. Some were surprised to find that Barrio Logan, for example, an extremely dense neighborhood, is in the same congressional district as Campo, a rural area 50 miles away.

Students learned about various methods of measuring whether a district had been gerrymandered: proportional representation, wasted votes, and the concept of "compactness," a way to describe the variability within a district and thus measure its fairness in terms of representing voters.

Students examined various methods of measuring compactness, applying visual and spatial reasoning, geometric ratios and areas, and optimization to manipulate several variables while meeting real world constraints. Students studied voting theory, group theory, social choice theory, and topology. They learned various mathematical concepts that describe distributions of demographic data and voting behavior, such as Pareto distributions, monotonicity, and the independence of irrelevant alternatives.

Students also learned that many state legislatures determine voting districts, which are thus subject to political manipulation. In their state, California, however, an independent citizen commission is responsible, and citizens may submit proposed reforms. That discovery led to several groups focusing on district reform as a final project.

Students also looked at voting through a social justice lens, examining current and historical implications of redlining, Supreme Court decisions on the immigration question on the census, and the Voting Rights Act and minority opportunity districts. Understanding local representation and how school districts are drawn were also hot topics amongst the students.

Students grappled with how to inform voters about the importance of their voice and their vote, and yet, because of a given system or the way a district was drawn, some votes in certain areas wouldn't 'count'.

EXHIBITION AND ASSESSMENT

Students were assessed throughout the project, as to how they worked in a group together, went through the mathematics for their voting method or proposed districts, their writing products, and how well they communicated with others during the project and exhibition.

Students created posters explaining voting systems and redistricting issues/proposals. An exhibition rehearsal was held for younger students in the school; students took note of questions they did not answer well and prepared for the final exhibition for parents and community members. Guests at the exhibition were given ballots to vote for the voting method they considered to be most fair. Students were surprised at how many adults who had been voters for many years did not know about many of the fairness issues they had studied.

NASA's real world problems of growing food in space inspired teachers Meghan White, Connor Tait, and Kara Quinlan to create a project that would combine plant biology concepts and scientific methods with the motivation of an actual challenge—growing food with no natural light, no gravity, and hardly any space. They wanted each of their 11th grade scientists to have the opportunity to solve NASA's challenge regarding improving botanical methods for astronauts on the International Space Station. Students created a plant scientific research proposal and poster for NASA's Growing Beyond Earth Maker Challenge. By participating in professional experiments, students had the opportunity to increase their scientific literacy and practices.

To start, students uncovered their own previous understandings about photosynthesis and botany and created research questions that they wanted to pursue. Each scientist designed their own plant experiment and took independent, control, and plant growth data daily. Each week, teachers modeled and scaffolded the research and scientific writing process step by step for their research proposals and scientific posters. Multiple peer, group, teacher, and professional critiques with rubrics spurred students to revise and improve before they turned in their final product to NASA for exhibition.

GROWING BEYOND EARTH

ELEVENTH GRADE • BIOLOGY • ENVIRONMENTAL SCIENCE

HIGH TECH HIGH CHULA VISTA

MEGHAN WHITE • CONNOR TAIT • KARA QUINLAN

LEARNING GOALS

- To understand photosynthesis and the constraints of growing in space
- To understand and practice experimental methods
- To learn to record, monitor, and analyze data using spreadsheets
- To develop scientific writing, critique, and editing skills

Next, the team participated in NASA and Fairchild Botanical Garden's Growing Beyond Earth (GBE) experiment, where NASA sent them lettuce seed species to test. Students set up the GBE experiment, planted space lettuce, and monitored growth, biomass, temperature, and humidity daily, learning how to monitor and analyze data using Google Sheets.

Finally, students harvested the lettuce and determined which species had the most edible biomass. Students created a scientific poster with methods, data, results, conclusion, and recommendations to NASA about which lettuce species to grow on the International Space Station.

After completing this experiment, each scientist created and wrote their own research proposal and submitted it to NASA for Trial 2 of the Growing Beyond Earth challenge. When accepted, the whole team will present its research in Florida at the John F. Kennedy Space Center.

SCAFFOLDING

Teachers created models of final products. They supported the scientific writing process by breaking down each section with feedback and critique from peers and teachers with a rubric, vocabulary word walls, annotation strategies for scientific articles with new material, and used visuals for directions.

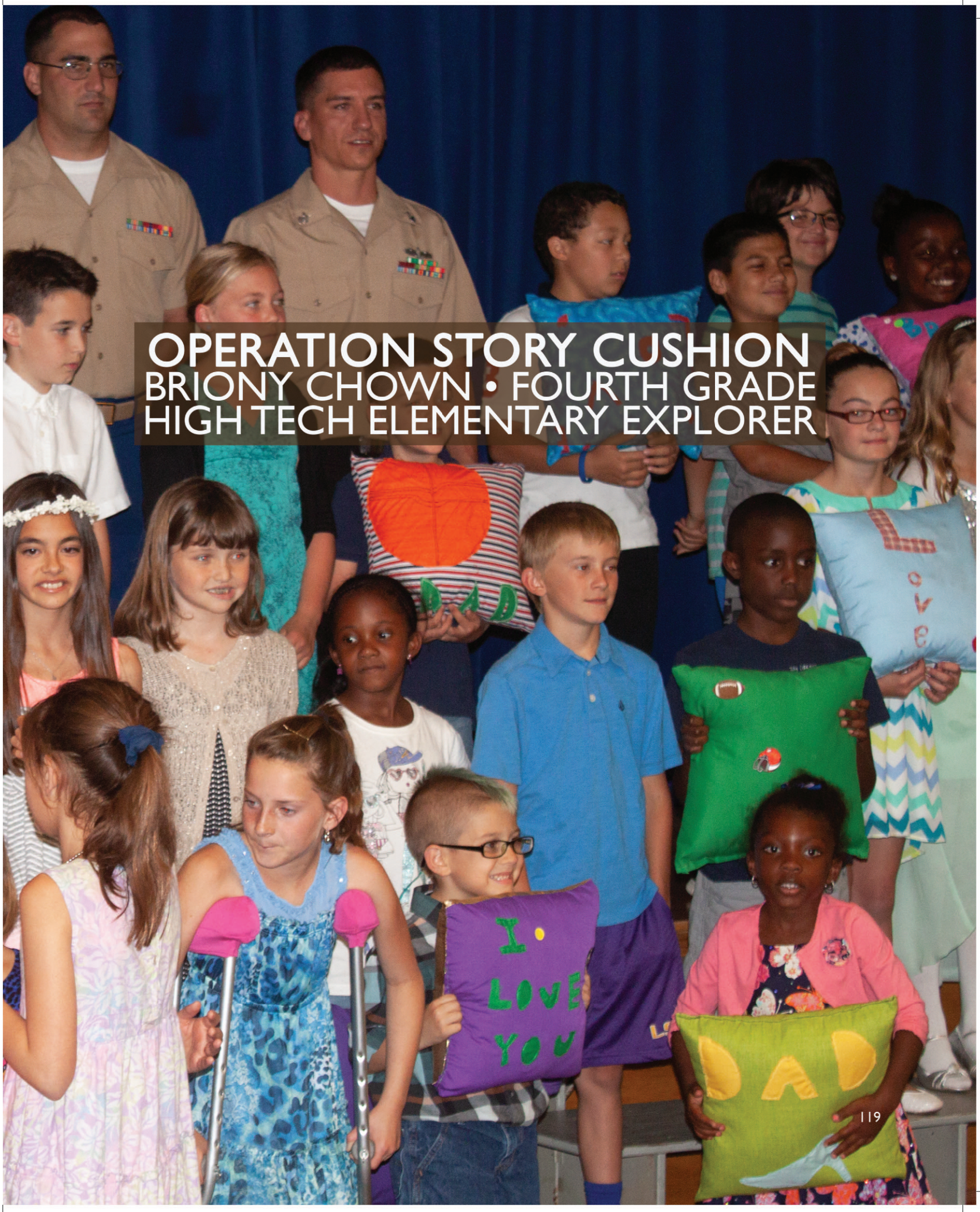
EXHIBITION

Students presented their experiments and posters during a school-wide Winter Exhibition. They also submitted their research posters and proposals to NASA and the Fairchild Botanical Garden's Growing Beyond Earth research contest. The team was accepted and the students have the honor of participating in NASA's second phase of the challenge.

Fifty four Navy ships call San Diego home

Fifty four Navy ships call San Diego home and more than 100,000 active duty military personnel live in San Diego County. That means there are a lot of children in San Diego schools and neighborhoods whose parents are in the military and may be deployed. Fourth grade teacher Briony Chown designed a project that enabled her students to develop empathy for children whose parents are absent and use their skills to create something to help.

Students interviewed younger children (second grade) and parents in a neighboring school located next to military housing in order to create a "story cushion"– a pillow with voice recorded chips so that children could listen to their parent's voice whenever they wanted.



OPERATION STORY CUSHION

BRIONY CHOWN • FOURTH GRADE
HIGH TECH ELEMENTARY EXPLORER

LEARNING GOALS

- To learn about the local community
- To develop empathy towards other students
- To understand that students can create something that helps others (without just giving money)
- To use writing to reflect and connect with others
- To organize community events
- To learn how to operate within a budget
- To learn to sew

In addition, Briony hoped this project would enage her students in considering the following questions:

How are memories and stories important in our lives? What makes a successful interview? How can we write and deliver a speech that connects with our audience? How can we raise money for something we care about? What is a budget and how do we manage it? What is the role of the military in San Diego? How can we use writing to remember events and better understand our feelings and questions?

To launch the project, Briony invited members of the military and one of their daughters in to talk about their jobs and families and how it felt when a family member was deployed. To practice the idea of the "story cushion," students interviewed their own parents and made prototype recordings and pillows. The class estimated what supplies they would need to create the cushions and developed a budget. Periodically they revisited their budget to check whether they were staying within it. Students brainstormed interview questions and how to make their younger buddies comfortable. After several visits, they held an evening event wherein they could interview and record their parents. In the final leg of the project, they completed their story cushions, planned their exhibition/celebration with their buddies, and exhibited their work.

Throughout the project, pairs of students wrote blog posts about each phase of the project (and commented on each other's posts), which encouraged reflection and documented the project process for students and families.

ASSESSMENT

Many project elements provided opportunities for assessment: reflection journals, critique sessions, interview questions, fundraising letters, and blog posts.

EXHIBITION

Students planned and held a celebration with their second grade buddies, where they presented their story cushions, as well as letters describing their process of making the cushion. They also held an exhibition at their own school for families and other students to show their pillows, writings, and process.

By the time they had reached their junior year,

Matt Simon and Nuvia Ruland's students had lived through the shooting death of one of their classmates, the Sandy Hook school shooting, and the Colorado movie theater shooting. The teachers met with some students in the spring of their 10th grade year, and together decided they wanted to focus the next year on the causes of gun violence and how to prevent it.

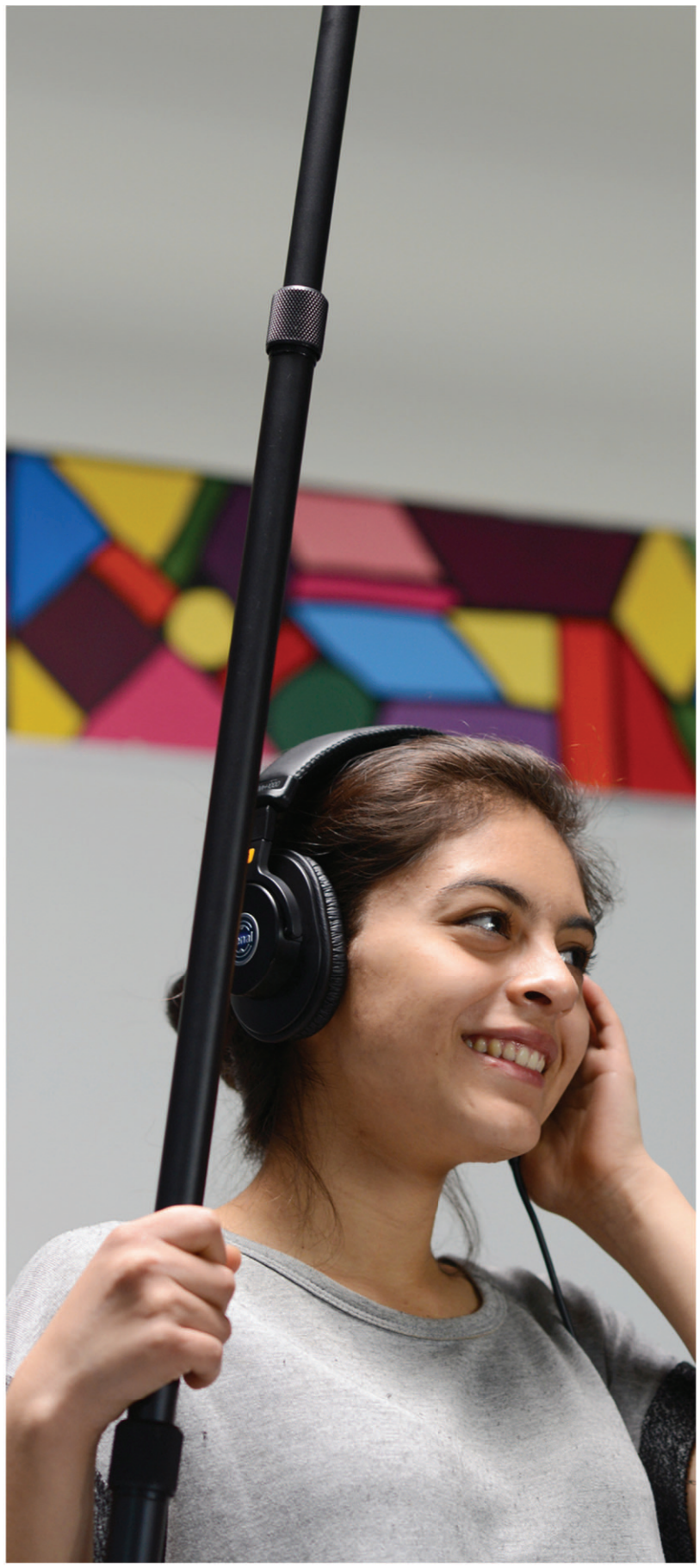
Within that large topic, Matt and Nuvia set up structures for students' ideas and opinions to shape the specifics of the project. According to Nuvia, in the early days of the project, there were many gallery walks and talks, with "whiteboards just filled with students' ideas about the causes of violence."

Nuvia had a close relationship with a family who had lost a child in the Sandy Hook shooting. The parents came to speak to the class on the anniversary of the shooting, urging the students to focus on root causes, and particularly mental health.

The visit from Avielle's parents helped students realize that the issues of gun rights and gun control were extremely polarizing; even within the class there were strong opposing opinions. They decided they wanted to focus on root causes of violence and how it could be prevented. Soon, themes began to emerge, such as brain health, juvenile justice, and peer-to-peer relationships. Student groups formed to research these themes and their relationship to violence. The teachers assisted in developing reading lists organized around each theme.

As they were researching, the students decided that they wanted to make a documentary film—one of several possible final products. With that daunting goal, Nuvia and Matt realized they would need to raise a substantial amount of money. They invited in a colleague who had launched a successful Kickstarter campaign to teach the students the steps involved. This became a mini-project in itself, as a successful Kickstarter campaign involves budgeting, marketing, data analysis, event planning, storytelling, a compelling video clip, and motivational writing.

The team was able to partner with the Media Arts Center of San Diego, which sent a visiting educator several times a week to teach camera work, editing, and film production. In humanities, students researched their themes and identified experts that they wanted to interview, either on camera or for background information. In biology, students focused on brain health and its relationship to violence, reading *The Anatomy of Violence* and studying mental illnesses strongly correlated with violence.



BEYOND THE CROSSFIRE

NUVIA RULAND • MATT SIMON

ELEVENTH GRADE

HUMANITIES • BIOLOGY

HIGH TECH HIGH CHULA VISTA

LEARNING GOALS

Matt and Nuvia thought about their goals for students in three categories: skills, content, and mindsets.

SKILLS

- To learn the skills of all aspects of film production: planning, budgeting, fundraising, writing, executive production, camera work, editing
- To develop research skills
- To develop persuasive writing skills
- To develop interviewing skills

CONTENT

- To understand the complexities of a pressing issue facing the country
- To learn about brain health, mental illnesses, and their relationship to violence
- To understand social policy (or lack thereof) related to violence in the US

MINDSETS

- To persevere through a complex multi-stage project
- To collaborate well with diverse teams with differing opinions
- To experience the motivation to create a positive contribution in a time of grief and disillusionment

During the fall semester, students were engaged in research, interviewing experts for background, and creating the Kickstarter campaign for fundraising.

The actual film production began in the spring semester. As at many high schools, the spring semester of 11th grade at HTH is jam-packed. There are college visits, internships, and SAT tests to be taken. The idea of squeezing in the production of a film was daunting. Students had identified possible interviewees for the film and many were not in San Diego. Trips were taken to LA, Chicago, San Antonio, and Newtown Connecticut. Many students and the teachers spent their two week spring break traveling and filming. Students were able to interview community leaders and young people in mentorship programs; the family of a young man with schizophrenia; and several families that had lost children at Sandy Hook.

Despite everyone's best efforts, it was not possible to finish all of the filming and editing in one semester. In the fall, a group of about half of the students opted to finish it in a 6th period (elective) class. The final 59min documentary film was screened to a full house of students, families and supporters at local movie theater. Later it was submitted and selected for the San Diego Latino Film Festival.

EXHIBITION

Since the final film was not finished, students exhibited their process at the HTHCV school-wide exhibition Festival del Sol, including film clips, listening stations, research, and T-shirts they had designed for the Kickstarter campaign. Small clips of the film were selected by the first White House Student Film Festival, and the San Diego Latino Film Festival.

Photos by Meghan Siddall

Official Selection
White House Film Festival
2014

Best Documentary
San Diego Latino Film Festival
2015

FORTY-FIVE HIGH SCHOOL STUDENTS SEEK TO ANSWER ONE QUESTION...

HOW CAN WE REDUCE THE AMOUNT OF VIOLENCE IN THE U.S.?

BEYOND THE CROSSFIRE

THE SEAN AND KYLE IMAGINE FUND AND BTC KICKSTARTER SUPPORTERS PRESENT
IN ASSOCIATION WITH THE AVIELLE FOUNDATION A FILM BY THE 45 'BEYOND THE CROSSFIRE' MUSIC BY ALEXIS AND SAM DIRECTOR OF PHOTOGRAPHY PETER VIOLANTE
EDITED BY GABE GARCIA MICHAEL BERRY AND VENKAT AKKINEPALLY EXECUTIVE PRODUCERS MATT SIMON NUVIA RULAND AND MARIA PE SUPERVISING PRODUCER JESSE KELLER
PRODUCED BY THE 45 WRITTEN AND DIRECTED BY CIERA YBARRA SABRINA CREMASCOLI GABE GARCIA KAREN VILLALBAZO EDUARDO BIMBELA JOANNA COLLAZO SHAYNE COLE AND MICHAEL BERRY
IN LOVING MEMORY OF SEAN FUCHS KYLE FUCHS AND AVIELLE ROSE RICHMAN

HIGH TECH HIGH CHULA VISTA

Media Arts CENTER SAN DIEGO

6.15.15

PG

California Arts Council

What are the creatures in our backyard

and how can we care for them? The core purpose of this project was for students to develop a connection to the natural world, begin to learn about the complicated balance of ecosystems, and develop an interest in becoming stewards of the environment.

Through a series of field experiences and expert visitors, students explored a variety of ecosystems: ocean, fresh water, inland and coastal lands, to understand the life cycles within each one, and the relationships among plant and animal species. Students examined the role of pollinators and re-planted a school garden.

One class partnered with Trout in the Classroom to hatch and raise trout, and then went in search of a clean and healthy water ecosystem in which to release them. After eight weeks, the students became quite attached to the fish, and the pressing need to find a river or lake where they could survive added a real-world urgency to the students' semester-long research into ecosystems.

THE BACKYARD ECOSYSTEM PROJECT

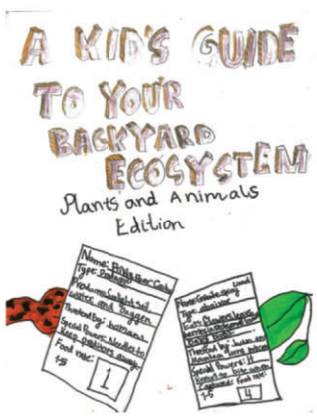
JULIA JACOBSEN • PAUL NORTH • LISA SALDIAS
HIGH TECH ELEMENTARY CHULA VISTA
THIRD GRADE

LEARNING GOALS

- To learn about various ecosystems
- To understand human impact on ecosystems
- To develop as non-fiction writers, through research, drafting, critique, and revision
- To understand how species are interconnected
- To understand life cycles of various species: fish, insects, animals, plants
- To develop awareness and the desire to become stewards of the environment

Students decided that they wanted to create *A Kid's Guide to Your Backyard Ecosystem* explaining all they had learned about animal adaptations, species interrelationships in ecosystems, and human impact. This book became one of the final products of the project. Each student wrote a chapter about a part of the ecosystem that interested them. The class worked together to organize the chapters into a flow that made sense, drafted their chapters, designed their layouts, and helped each other revise and edit to make a final product.

One of the students had a hobby of creating "Bino Cards" since kindergarten—similar to Pokemon cards, but with dinosaur-like creatures. The class built on this idea to create an ecosystem game with Pokemon-like cards for each animal in the ecosystem, complete with powers, predators, prey, food needs, etc. The goal of the game is to build an ecosystem that can support an apex predator.



ASSESSMENT

Teachers integrated Lucy Calkins' Units of Study for the reading and writing parts of this project, so they were assessing students during reading and writing workshop times. Student-created scientific models were an important way that teachers assessed students' understanding of science content. Students created these models about ecological relationships throughout the project.

One of the project's goals was to awaken a sense of environmental stewardship in students. Although there was no direct individualized assessment of that transformation, students designed their next semester project to include planting a pollinator garden in Otay Lakes, a preserve they had visited multiple times.

SCAFFOLDING AND DIFFERENTIATION

The adoption/adaptation of the "Bino" game created accessibility and a leadership opportunity for a group of students who had previously been less than fully engaged. In addition to critique and revision, teachers scaffolded the skills required for book production with many micro-models. For example, what does a good table of contents look like? What does a good caption look like? What does a good explanatory diagram look like?

EXHIBITION

At the exhibition, students taught their families and other students how to play their ecosystem game. They presented their *Kids' Guide to Your Backyard Ecosystem* books, and showed their process of learning. Since field experiences were such an important part of the project, students also took their parents on a hike, along the way showing them various species and what they had learned about their life cycles.

A truly difficult year inspired this project.

The school community was dealing with a couple of tragic losses over the past few years due to suicide. In addition, after learning that suicide was the second largest killer of young people (behind accidents), and realizing the growing need for education about mental health, the idea for The Voiceless project was born.

The teachers met and discussed whether it was advisable to do a project on such a sensitive subject. They decided it was important to engage their students, despite the difficult emotional issues that could arise. They partnered with Survivors of Suicide Loss in San Diego, a non-profit organization. Through these dedicated people, the students and teachers were partnered with four families willing to discuss their loss of a loved one on camera for a student-run video and banner campaign.

The idea was simple in concept and incredibly sensitive in execution. Students would run the entire scheduling, interviewing process, filming, and photo shoot of the four families to create a short public service announcement video for Survivors of Suicide Loss. Large, four-foot, professional quality vinyl banners would be made to offer to other middle schools and high schools to spread awareness of mental health and suicide prevention.

Through countless hours of producing content, organizing it, and editing, the students made a moving and professional quality video and powerful large banners ready to be used in other schools. It was an honor for the students and the teachers to connect to real families with intense and meaningful stories to share. Survivors of Suicide Loss features the film on its website.

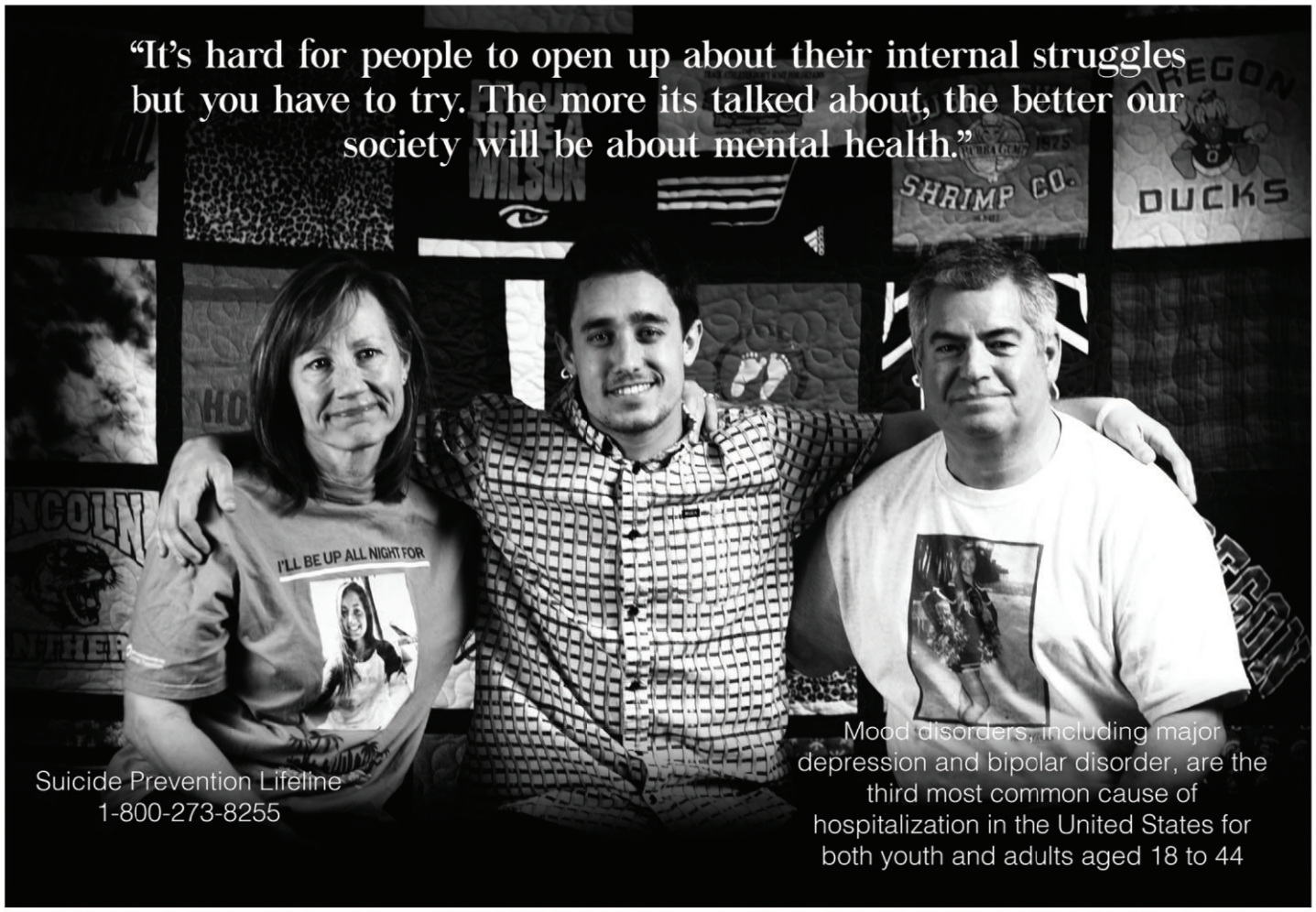
LEARNING GOALS

- To build empathy through true, real-world connections
- To learn the difference between mental and physical health and how and where they intersect
- To understand the power of students' voices as storytellers in even the most serious of topics
- To learn to write, direct, and edit professional quality video

EXHIBITION AND ASSESSMENT

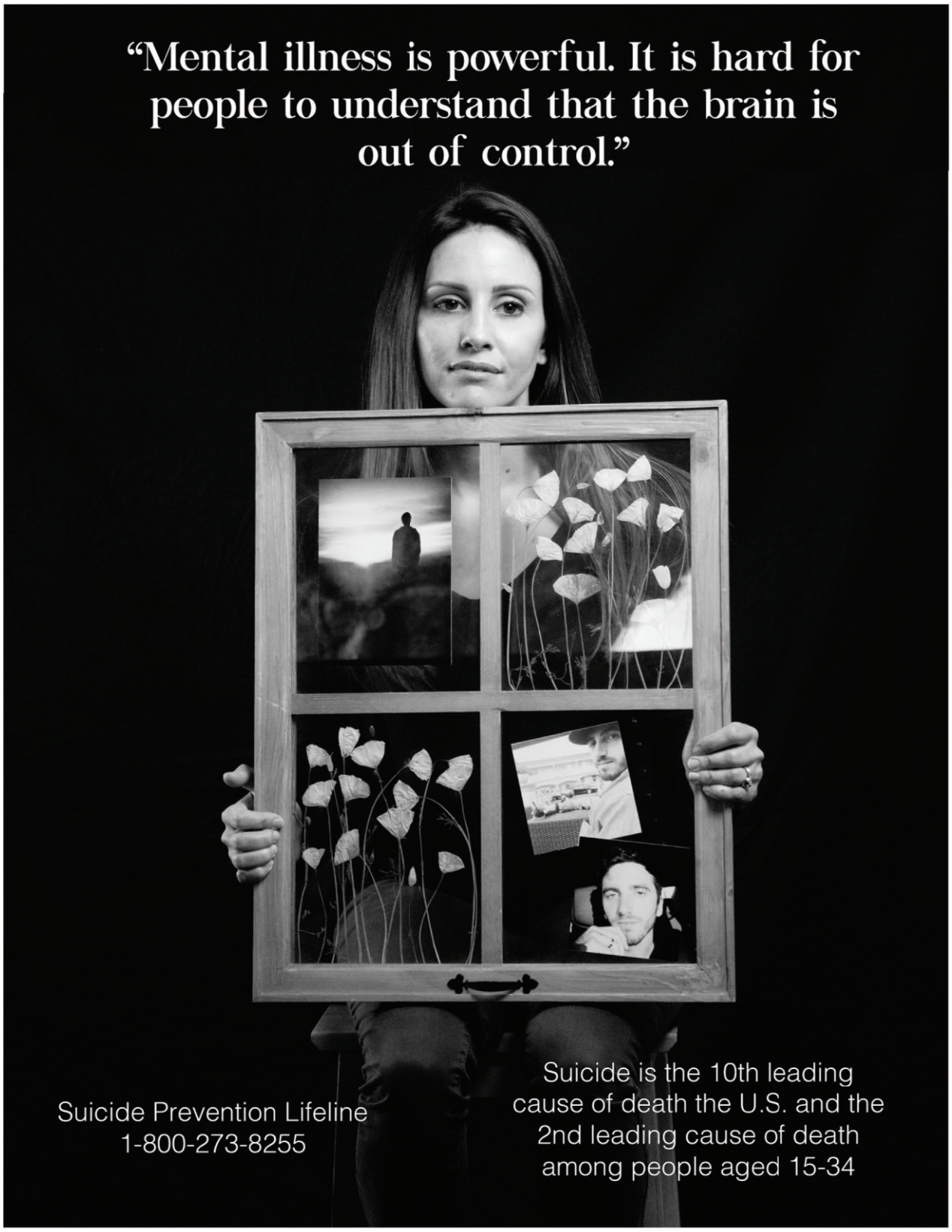
The all-school exhibition included guests from the organization and some of the family members who shared their stories. The event was promoted by the organization on their website as well, so it was open to the community.

Assessment was done throughout the project. Though the students worked in groups, assessment was individual. Each student was given individual grades connected to their individual efforts regarding content, filming, editing, executive functioning, and group collaboration.



THE VOICELESS

COREY CLARK • BRENT SPIRNAK • CURTIS TAYLOR
SIXTH GRADE • HIGH TECH MIDDLE NORTH COUNTY



“Is it safe to go in the water?”

When then-Governor Arnold Schwarzenegger vetoed the budget for coastal water quality testing in California, he gave Randy Scherer and Brandon Davidson the inspiration for their project.

With the elimination of publicly funded water quality monitoring, they and their students decided to test the quality of San Diego’s coastal waters and produce media in multiple formats to inform the public of what they discovered.

The teachers connected with the local environmental organizations Coastkeeper, Surfrider, and WiLDCOAST, which all agreed to support the project by teaching students, donating water testing equipment, and critiquing student work.

To decide what coastal environments to focus on, the class initially put a giant map on the classroom wall, and students stuck pins where they wanted to focus. From an initial 50 pins, they narrowed it down to 10 locations, using criteria the students and teachers came up with together: they needed to include fresh, salt, and brackish water; they wanted places that were important culturally, economically, and ecologically. Once the sites were chosen, groups formed based on interest and proximity to home.

The students soon realized that water quality in a given location is far from static; it varies widely with weather and other factors. During the project, students went into the field to test the water at their site at least once a week, and more frequently if there was a major rainfall. Data from the testing was uploaded to the Coastkeeper website.

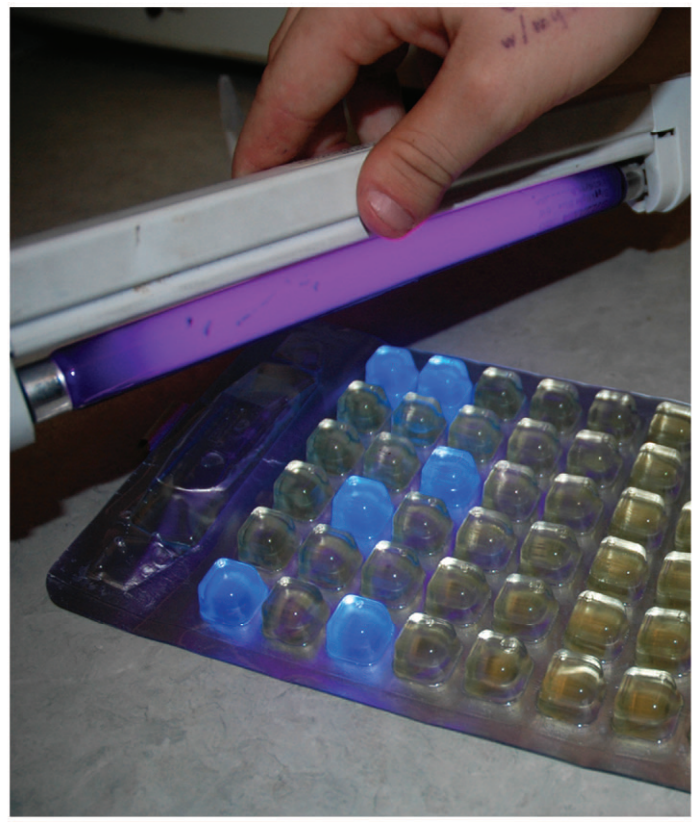
MEDIA SAVES THE BEACH
BRANDON DAVIDSON • RANDY SCHERER
ELEVENTH GRADE • BIOLOGY • HUMANITIES
HIGH TECH HIGH MEDIA ARTS

LEARNING GOALS

- To understand the causes and impacts of water pollution
- To learn the biological structure of common bacterial pollutants
- To learn to test water quality
- To formulate a research question and pursue data from multiple sources
- To write an evidence-based narrative or script
- To develop writing, editing, and critique skills
- To create a professional quality media product

Students were challenged to come up with a research question to pursue. They consulted with collaborating organizations about what research they would find useful, and also came up with their own ideas. To refine their questions, the teachers put up a grid with 50 cells on the white board. Each research idea had to stand up to critique: Was it too broad? Was it actionable? Could relevant data be found? Some students chose more humanities-oriented questions, such as, "What impact does San Diego media have on public perceptions of Ocean Beach?" Others were more scientific, such as, "What are the impacts of runoff on the San Diego River?"

The class grouped their research ideas into geographic categories and also thematic ones, such as public perceptions or economic impacts. As the semester progressed, discussions took place in both groupings. Some days, students might be in a group where everyone was focusing on economic impacts at various sites across the city. On another day, students might be in a group all focused on one area, but some were looking at total coliform counts, while others were investigating economic impacts or public awareness.



Each student or pair of students chose a media product to communicate their findings. Some students chose to write articles; others published a tide calendar; others made videos or websites or photo essays. The focus was on products for public consumption, so there was an assumption of professional quality. To assure that level of quality, multiple critiques took place, including critique from professionals. Many of the products were put to immediate use by the collaborating organizations.

As their biology teacher, Brandon also tasked the students with producing a Beach Report. In a lab report format, they described their site, compiled and analyzed all of their primary water quality data, and combined it with secondary research on economic and environmental issues.

EXHIBITION

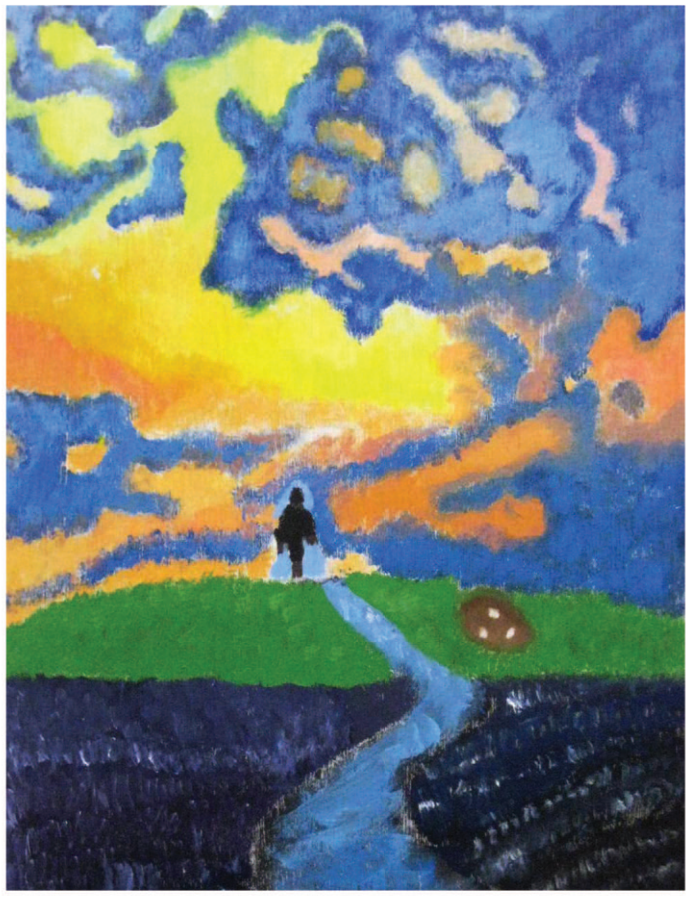
At the final exhibition, students presented their films, writing, calendars, and photography to the community. They also created an interactive station where participants learned how to test and analyze water samples. The collaborating organizations continued to exhibit the work in their offices, materials, and websites.

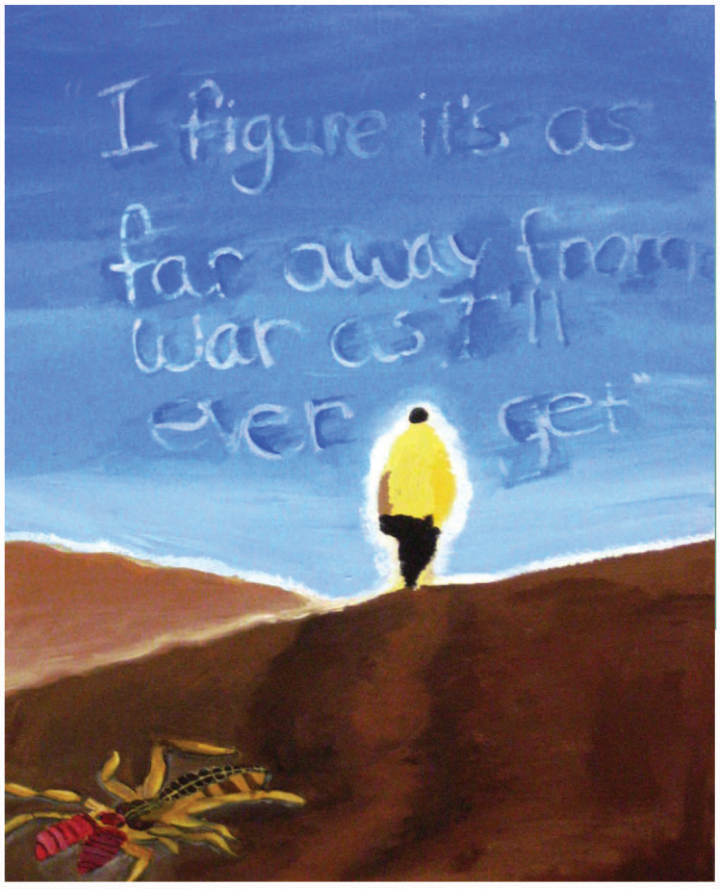
"Who are our unsung heroes?"

The Voices and Visions project started out as a challenge for seniors to experience what it is like to function as a working artist: "to conceive, communicate, collaborate, and create a product for a specific client and situation." Jeremy Farson asked his students to contact local organizations, find out if they had artistic or graphic design needs, and make a proposal to donate their services. As their humanities teacher, Stephanie Lytle helped students research local organizations and develop outreach materials, including proposals, artistic resumes, and cover letters.

When they discovered the Veteran's Village of San Diego (VVSD), the project shifted. San Diego is a community rich with veterans and unfortunately, many of them suffer from post-traumatic stress disorder, homelessness, or addiction. As Stephanie said, "it became clear that our outreach project could go deep. We knew that there was something very simple that we could do for our San Diego veterans: listen."

The class made preparations to interview veterans, write about their stories, and co-design a piece of art with them. Meanwhile, they read *Beowulf* in Stephanie's English class, focusing especially on the "scop," a singer-storyteller, as an oral historian and preserver of the stories of the era's heroes. Students examined this role in the current day: "Who do our contemporary scops celebrate? Who should they celebrate? Who are our 'unsung' heroes?' Later in the semester, the class read Tim O'Brien's *The Things They Carried*, drawing parallels between his characters and the veterans they were interviewing.





VOICES AND VISIONS

JEREMY FARSON • STEPHANIE LYTLE

TWELFTH GRADE • ENGLISH • ART

HIGH TECH HIGH INTERNATIONAL

LEARNING GOALS

- To experience working with a client to create art
- To develop interviewing skills
- To develop close reading and literary analysis skills
- To see thematic connections between modern events and literature from very different times
- To experience the ability to connect and contribute to another individual positively
- To develop "documentary poetry" writing, editing, and revision skills

Each student was matched with a resident of Veteran's Village. They listened to and recorded their story. Back at school they transcribed the story and used it to create a "documentary poem." Students listened to and followed the method of sociologist/writer/actor Anna Deveare Smith (*Fires in the Mirror, Twilight: Los Angeles, Notes From The Field, Let Me Down Easy*) who extensively interviews people and then edits their words into compelling monologues/plays. Students reviewed their transcribed interview and selected the most powerful parts to tell the veteran's story in a 60-70 line poem.

In art class, students created paintings that represented each veteran's story. Some included a particular good luck charm that the veteran held dear. Some were more visceral—depicting a particular place or battle. According to Jeremy, "The project became something much deeper than what I had set out to do. No longer could it be about creating a painting that matched the drapes and looked good over the sofa...They were dealing with stories that were deeply personal and emotionally complex."

EXHIBITION

The veterans were invited to an evening at the school where each student read their poem while their painting was displayed in the foreground. Behind the speaker, images from the day of the interviews were projected. Following the readings, students reconnected with the individuals they had honored and personally delivered their paintings. The documentary poems were compiled and published in a book for the Veteran's Village of San Diego.

As one student reflected, "I felt a connection I've never felt to a complete stranger before, because from 'Hello, my name is…' to the actual reading of the poems, it was no longer a class project. I felt it was almost like my duty to share her story."

How do humans tell stories about nature? How do scientists use data to tell stories?

In Storytellers of the Land, fifth graders read and wrote origin stories about animals and nature and teamed up with a local conservation organization to analyze thousands of trail camera photos of local wildlife.

In collaboration with a local conservancy and river park, students were able to serve as citizen scientists as they helped land managers and conservation biologists identify and catalog local wildlife through camera trap photo analysis. With the help of rangers and biologists, students were taught field techniques for animal tracking and how data is used to make decisions about land use and animal conservation.

At the same time, students were exploring Pourquoi stories or origin stories that many cultures throughout history have used to explain why things are the way they are, such as "Why the Snake Has No Legs," or "How the Raccoon Got its Mask."

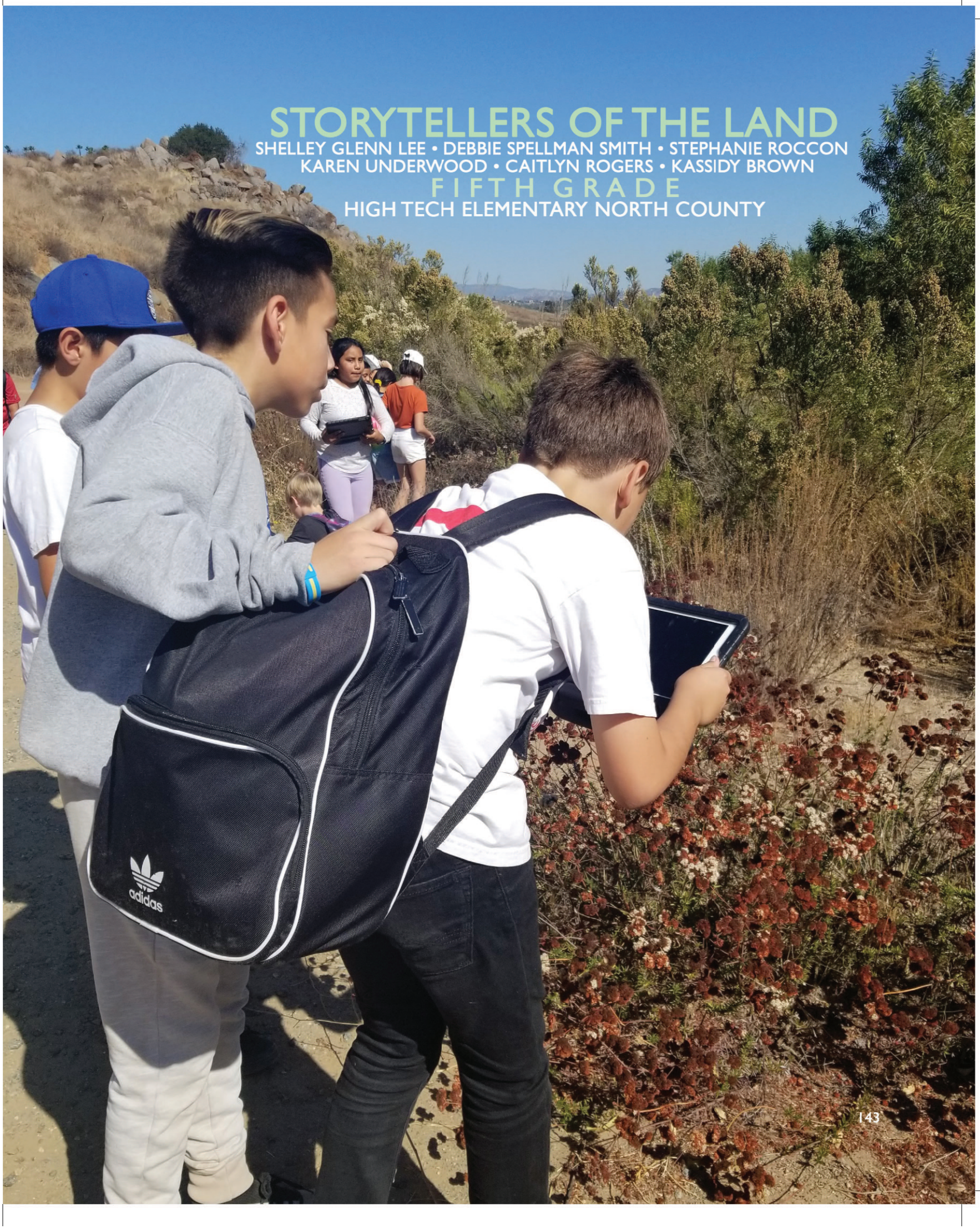
To launch the project, fifth graders visited the river park and met the rangers who would be their partners. They learned how to track animals in the field and how data from cameras helps in this process. The rangers explained why it was important to know how the animals were behaving in the park, and how they were being impacted by human activity. They also explored technology used by rangers and scientists, such as GPS markers and the application iNaturalist to identify plants and animals.

STORYTELLERS OF THE LAND

SHELLEY GLENN LEE • DEBBIE SPELLMAN SMITH • STEPHANIE ROCCON
KAREN UNDERWOOD • CAITLYN ROGERS • KASSIDY BROWN

FIFTH GRADE

HIGH TECH ELEMENTARY NORTH COUNTY



LEARNING GOALS

- To ask questions
- To develop and use models
- To plan and carry out an investigation
- To analyze and interpret data
- To use math to construct an explanation of scientific phenomena
- To construct an argument using evidence
- To obtain, evaluate, and communicate information
- To gain insight into culture and history through stories and myths
- To write, edit, and revise stories in a specific genre

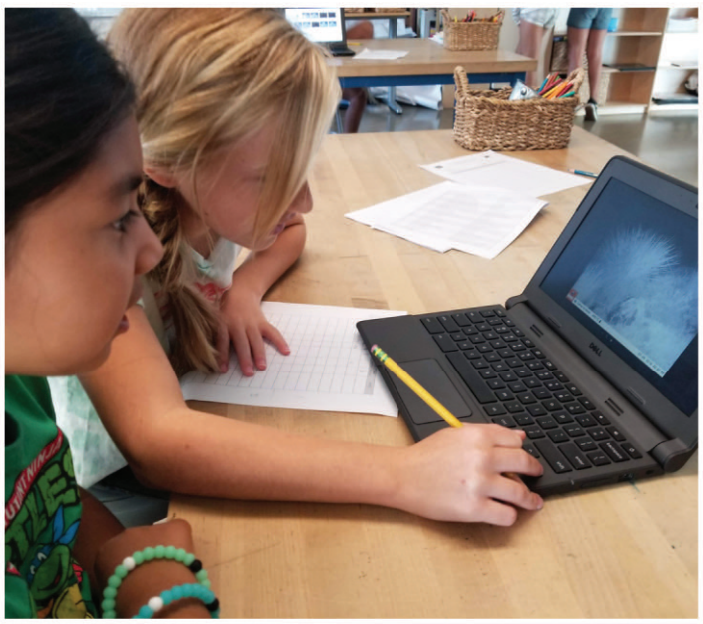
After analyzing thousands of photos from within the river park, students generated an inquiry question, such as "Which animals are most active at night?" or "When are coyotes active versus rabbits?" They visited with the rangers again to learn which questions would be helpful for them to answer. Their question would be used to inform the community about the patterns and behaviors of animals. It had to be relevant and also discoverable from the data.

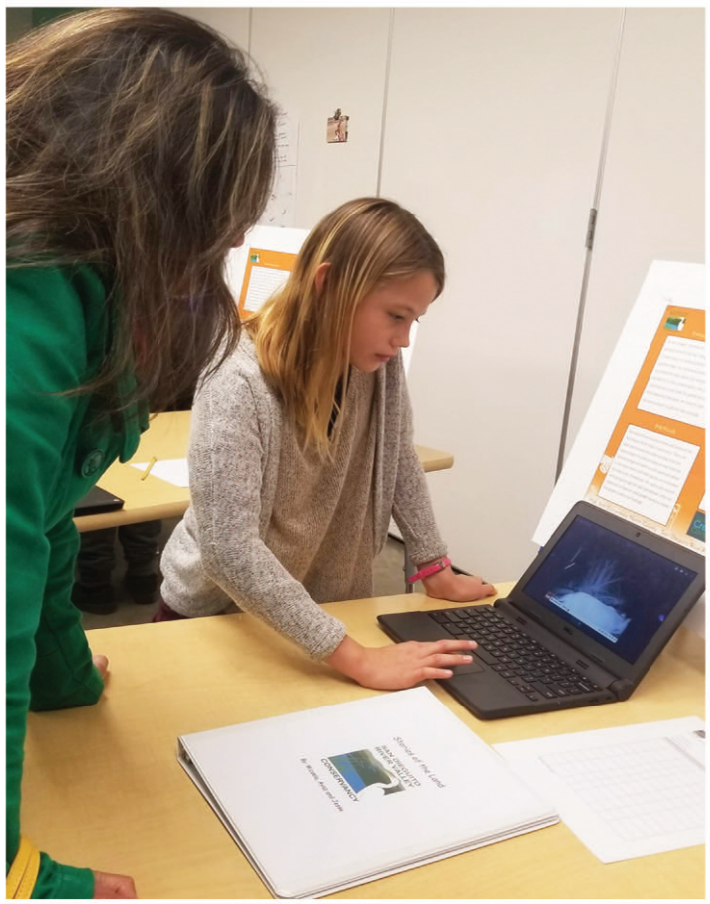
Once they had homed in on their research questions, students re-analyzed the data and used mathematical relationships and graphical representations to illustrate their findings. Direct instruction in the use of spreadsheets, percentages, and graphs, as well as models and lots of feedback, helped to support the process of representing mathematical conclusions visually.

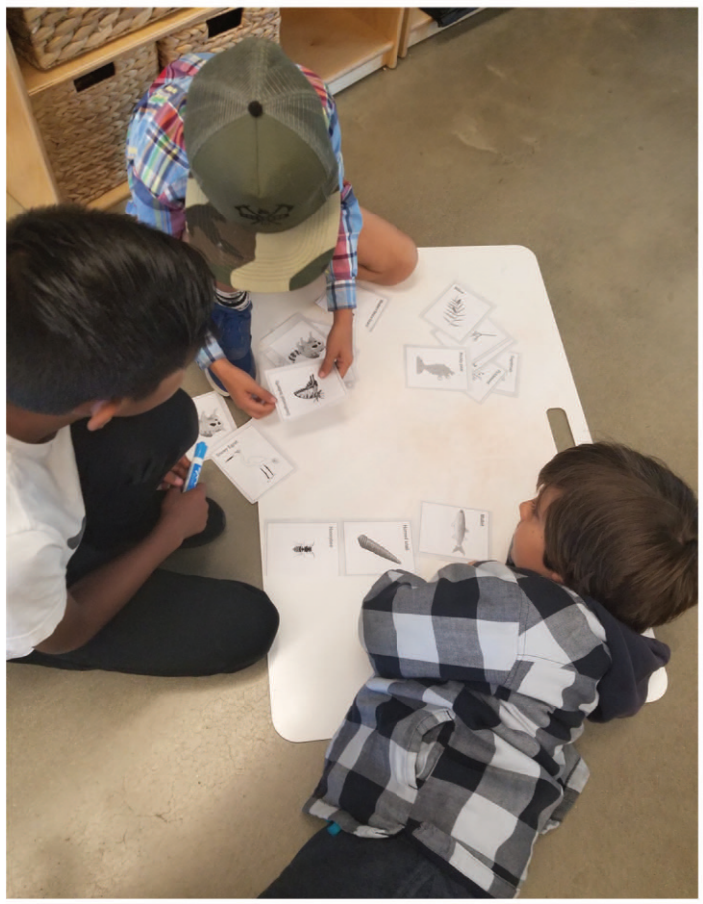
Meanwhile, students were also writing, editing, and illustrating a book of their own Pourqoi stories specific to San Diego, ranging from "Why the Leopard Shark is Quiet and Shy," to "How the California Chipmunk Got Its Stripes," to "Why California Has Fires."

EXHIBITION

Students held an exhibition at school, with staff, volunteers, and board members from the river park and conservancy as well as family members attending. Each team displayed their research on posters and also gave oral presentations. Their Pourquoi stories and books were displayed. Students also created a process display illustrating their learning process and the various stages of their research.







"What started as a simple look at the local boat channel turned into a study of the San Diego Bay's ecological history, which then became a consideration of the environment itself," recalled Tom Fehrenbacher. "In some sense, there was nothing planned about it."

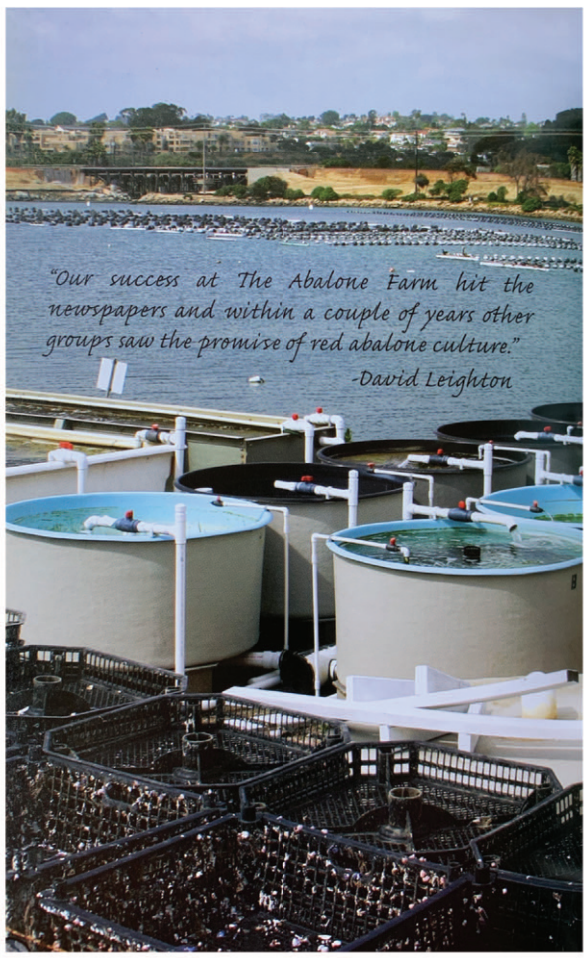
For more than a decade, from HTH's earliest years until Jay Vavra fell ill and passed away in 2014, Jay and Tom collaborated with their 11th grade students each year on books published about the San Diego Bay. In the first year, the project began as a simple field guide; students went down to the boat channel several days a week, taking samples and examining and documenting plant and animal species. For their humanities work, they wrote and published reflections and poems. The students could not help but notice the impact of human activity and development on the immediate environment, and that opened the door for much larger questions to be tackled. Before electronic publishing was available, they published their research, photography, and writing in a book entitled, *Two Sides of The Boat Channel.*

In subsequent years, students combined their field studies with a particular focus, publishing books entitled *Perspectives of the San Diego Bay; San Diego Bay: A Story of Exploitation and Restoration; San Diego Bay: A Call for Conservation; Biomimicry: Respecting Nature through Design;* and *Invasive Species: The Unknown War.*

In addition to writing poetry and reflections, students conducted interviews with local activists and researchers and tackled scientific articles and historical documents about the bay. Now each student was responsible not only for examining and documenting a particular species, but also researching and writing or co-writing a chapter based on an interview or a particular environmental issue impacting the bay.

LEARNING GOALS

- To learn how to do transect studies of a particular environment
- To learn to read and write scientific articles
- To consider questions of human progress, development, and environmental impact
- To be in nature repeatedly, and allow it to stimulate reflection and writing
- To develop critique, revision, and editing skills for publication
- To learn the scientific method via experiments related to local species and their survival under various conditions

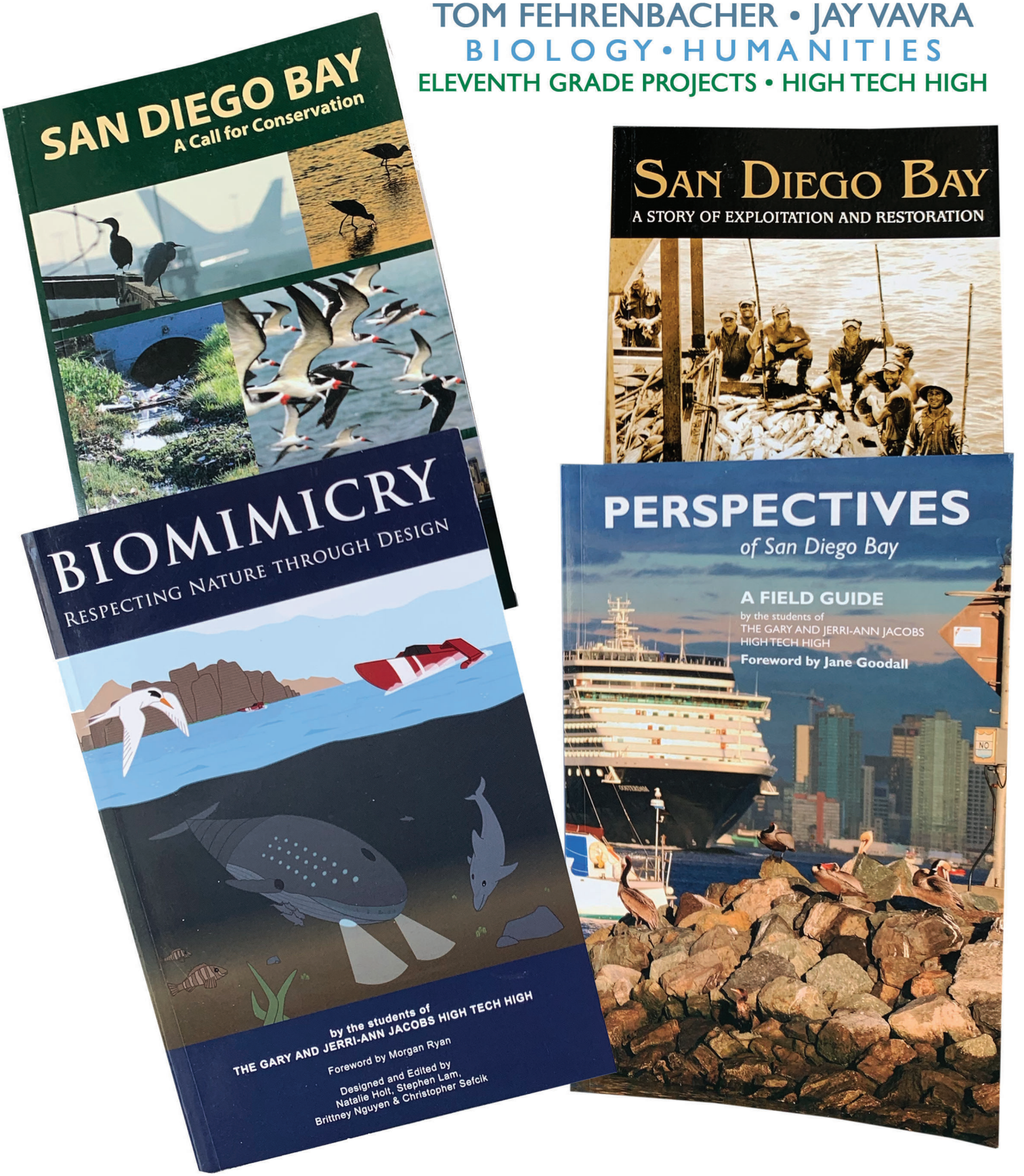


LOGS OF THE SAN DIEGO BAY

TOM FEHRENBACHER • JAY VAVRA

BIOLOGY • HUMANITIES

ELEVENTH GRADE PROJECTS • HIGH TECH HIGH



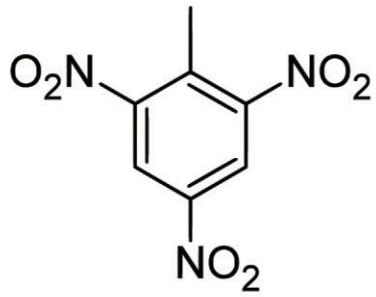
CHEMISTRY & CONFLICT

DAISY SHARROCK • PETER JANA

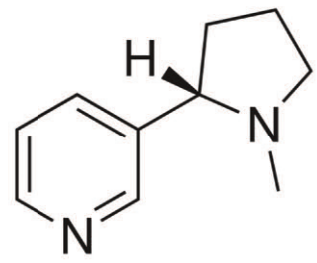
TENTH GRADE • HIGH TECH HIGH

The initial inspiration for Chemistry & Conflict came from a "Thing Biography" display at a Los Angeles bookstore. The display was of books about things such as salt, written from various perspectives. Daisy Sharrock and Peter Jana asked themselves, why not create a "thing biography" of chemicals and their role in history? As Peter put it, "sometimes we go through our studies and see the world in highly compartmentalized ways, so students might leave their education believing that history is not related to chemistry in any way. Well, it is, and it needs some thought to find those connections, but they're there. The world is a complex place...the interdisciplinary aspect of this work demonstrates the complexity of the world."

In planning for the project, Peter and Daisy brainstormed a list of "contentious molecules" and their links to conflicts throughout history and present day. In the chemistry lab, students launched the project by doing experiments to look at various chemical compounds. Then they chose a particular molecule and began to research its importance in current day and historical conflicts. Each molecule or compound led to historical and ethical questions, for example: how might the history of Africa been different if rubber had not been discovered there? Did the discovery of uranium's ability to generate power help or hinder mankind?



2-methyl-1,3,5-trinitrobenzene
TNT

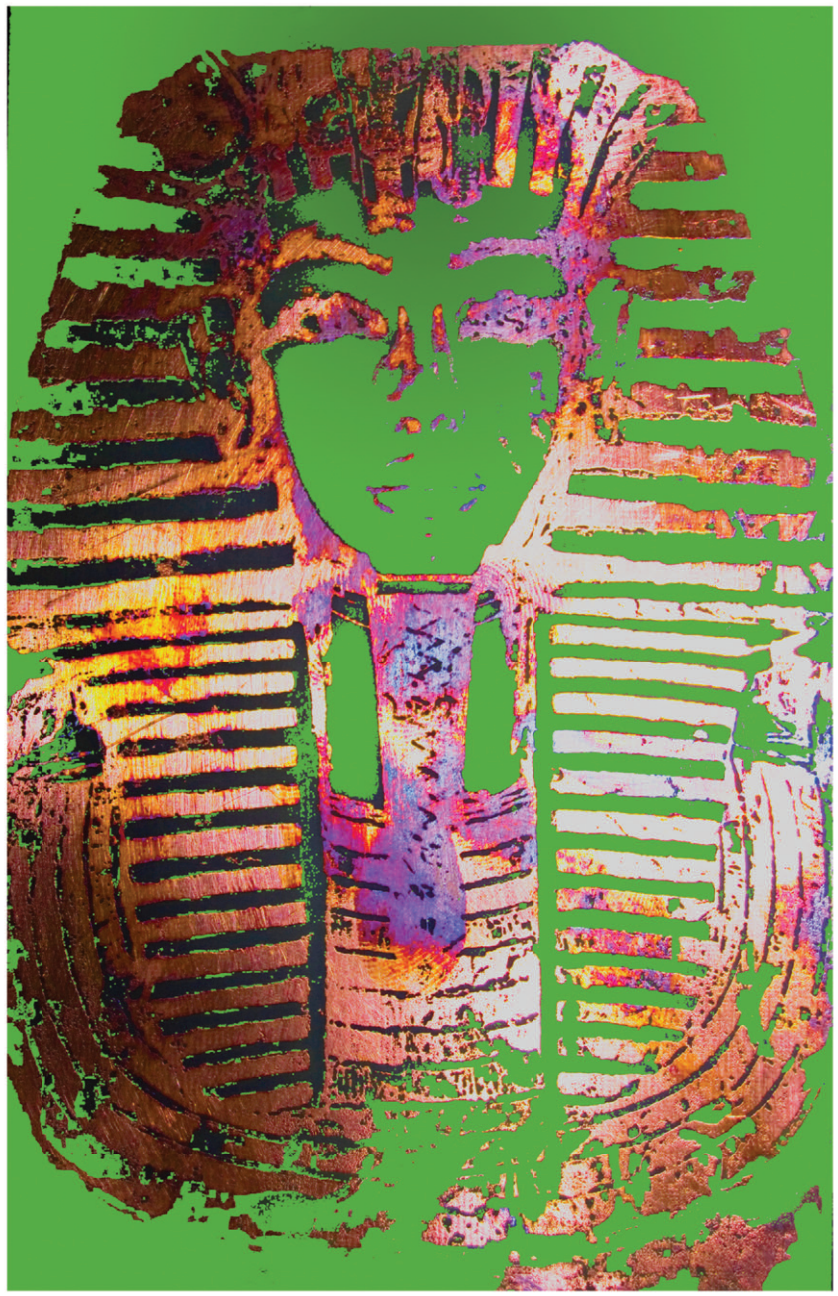


3-[(2S)-1-methylpyrrolidin-2-yl] pyridine
NICOTINE

Au

Chemical Properties

Gold is found in ores. An ore is a mined rock that contains desired metals or elements. Gold is a very malleable, soft, and ductile metal. The valence electrons in gold atoms share themselves with neighboring gold atoms, creating metallic bonds. Gold is very flexible because the atoms are not in permanent places and can move past one another in the "sea" of electrons. An ounce of gold beaten with tools can cover 300 square feet. The delocalized electrons also make gold a very good conductor of heat and electricity. Gold is also very heavy, and is usually alloyed to make it stronger. Gold does not rust or tarnish with exposure to oxygen. This is because it has a high electron valence potential and requires a great deal of energy give up an electron to create an ionic bond. Silver or copper eventually become tarnished and lose their luster. Gold does not do this, it will stay as shiny and as beautiful as the first time it comes out of the ore. This may be a reason why gold is one of the most valued elements.



Mask of Tutankhamun 1323 B.C. (Solid Gold)

In pairs, students conducted extensive research, including interviews with experts to discover their molecule's role in history. They wrote research papers, which went through multiple drafts. The project's final product was a book, in which each chapter was an edited down version of the research paper, illuminating the chemical compound's role in history. A student editorial board reviewed submissions and provided critique and revision suggestions.

In a final chemistry experiment, the book was illustrated with copper etchings created through a chemical redox reaction.

LEARNING GOALS

- To learn about a broad array of chemicals and chemical reactions, and their role in history
- To learn about transformational developments and conflicts in modern history
- To develop research and interviewing skills
- To develop writing and editing skills

ASSESSMENT AND EXHIBITION

Students presented their work at a public exhibition of learning held at High Tech High. Pairs of students displayed their written work and their etchings. They engaged in conversation with guests about the content of their chapter and multidisciplinary connections found within. To prepare for the public exhibition, students presented their work to teachers and peers and received feedback that refined their thinking and improved their writing.

The Democratic Republic of the Congo, Uganda, Burundi, and Rwanda are fighting over a black metallic ore called Coltan.

Colony Collapse Disorder.

At the time that Marissa Adams and Rhea Manguil first designed this project, scientists and environmentalists around the world were noticing this "mass death" phenomena among bees, and no one had discovered its cause. It seemed like the perfect opportunity for students to engage in the real science of an as yet unsolved problem.

Students investigated the role of bees in our ecosystem and the various ways bees are being threatened. To teach others about bees, they wrote and performed plays about some aspect of what they had learned. In order to create the most educational plays, students critiqued each other's work before performing their plays in front of an audience of parents and students.

Second graders also conducted a lunch-time survey of all of the food that was served and brought to school in lunch boxes. Ingredients were traced back to see whether a food's existence would be possible without bees. The students were surprised to learn just how crucial bees really are to our food supply.

THE BEE PROJECT

SECOND GRADE

HIGH TECH ELEMENTARY EXPLORER

MARISSA ADAMS • RHEA MANGUIL

LEARNING GOALS

- To understand the role of bees in our ecosystem
- To learn about the unique elements of bee communication and behavior
- To develop writing, editing, and critique skills
- To learn how scientists work to understand new and mysterious phenomena
- To experience the process of advocacy and to take action on an environmental problem

After discovering that bees need pesticide-free plants to thrive, the students decided it was important to write to their city government. They asked the city for a place to plant bee-friendly plants in the community. Second graders planted over 200 bee-friendly plants in a nearby canyon.

After reading a news article about how Lowe's was removing a particular pesticide from its shelves while Home Depot was only labeling its plants that contain this pesticide, students wrote letters to both home improvement stores. Students shared their ideas and requests for changes to be made within the corporations.

A community organization that raises bees across the border in Mexico came as experts to teach students more about honeybees. After this visit, students worked in groups to build beehives and design logos for each hive. The beehives were donated to the honey farm in Mexicali that supports local families and schools.

SCAFFOLDING AND DIFFERENTIATION

Much of the available information needed for research in this project was written for adults. Whole group shared reading, "what do you know and wonder" charts, and discussion of new vocabulary was essential for second graders to be able to access this material. Marissa and Rhea also used video of TED talks and newscasts. These too had to be chunked into five-minute bits and analyzed by the whole group.

EXHIBITION

The bee plays were performed for families and other students and videotaped. At the all-school exhibition, the plays were shown on screens. Student teams set up stations dedicated to one aspect or problem pertaining to bees, such as communication, life cycles, and colony collapse disorder. Charts and diagrams illustrated the lunchbox analysis, and a photo gallery documented the project process.

This project has been adapted by teachers in several other schools and has evolved along the way; more recent iterations have focused on all pollinators and their role in our ecosystem.

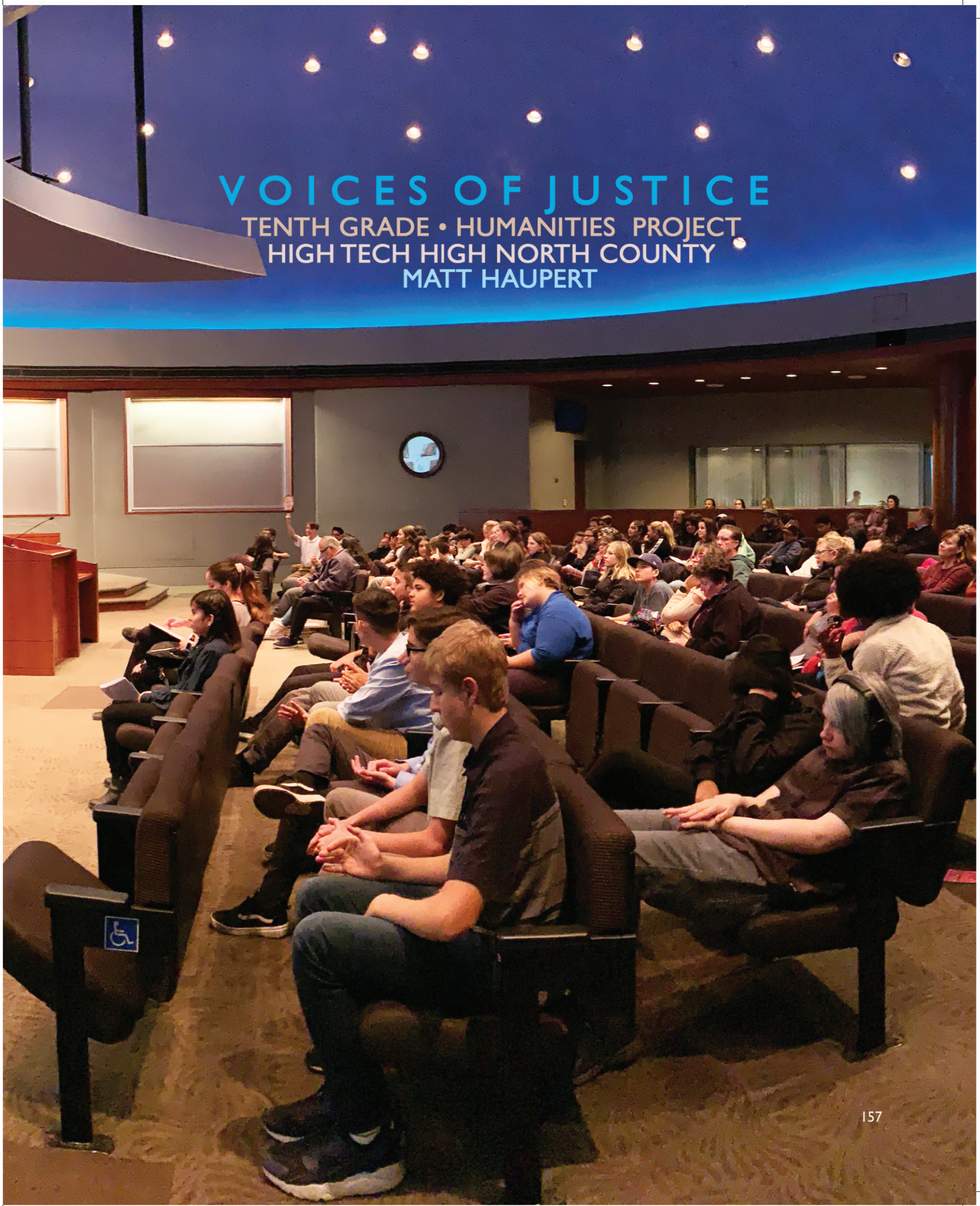
The ability to make your voice heard

through the ballot box is one of the core features of American democracy. Many people, however, head to the ballot box without an understanding of what they're actually voting for. According to Matt Haupert, this contradiction was the inspiration for this project.

The Voices of Justice project was really two separate projects that students worked on simultaneously in the same groups. One project was a political campaign simulation, in which students studied major issues facing our society, formed political parties, created party platforms, and nominated a candidate from within their group who would run for office. The groups campaigned for their candidates, and the project culminated in a political debate in the council chamber at City Hall, followed by an election.

For the second project, students conducted extensive interviews with people from the community who had personal stories about these societal issues and created an illustrated collection of oral histories.

The purpose of doing these two projects at once was so students could learn about these challenging topics both on a macro level and through personal experiences. Planning this was tricky, as students were juggling two major projects simultaneously. Students worked in groups of four, and roles were fluid, so that at any given time, all four students could be working on one project, or they could divide up and work on tasks for the separate projects depending on where they were falling behind and what deadlines were looming.


VOICES OF JUSTICE
TENTH GRADE • HUMANITIES PROJECT
HIGH TECH HIGH NORTH COUNTY
MATT HAUPERT

LEARNING GOALS

- To construct and analyze complex, sophisticated arguments in writing and speaking
- To write creative pieces that communicate an impactful message
- To develop a well-informed political ideology
- To become empathetic critical thinkers who are politically engaged, informed, and opinionated

SCAFFOLDING AND DIFFERENTIATION

By working on these two separate projects to explore the same societal issues, Matt was able to create many access points for students to engage with the project. While all students in the class were grappling with questions about complex issues like immigration, refugees, the opioid crisis, and homelessness, there were a variety of ways for them to engage with the material. Some students prepared for debates and wrote speeches as political candidates. Some designed websites for their group's political party. Some conducted interviews with members of the community and crafted them into compelling narratives. Others created artwork to highlight specific themes from the oral histories. Every student was able to enter the conversation.

ASSESSMENT AND EXHIBITION

Two exhibitions gave the students real world stakes and an authentic expectation for beautiful work. The oral history narratives, artwork, party platforms, and campaign websites all went through multiple rounds of revision. In preparation for the candidates' political debates, they had the chance to test their policy ideas by participating in seminars with experts in the different fields they would be debating. They discussed their ideas about immigration with an immigration attorney, shared their solutions for the opioid crisis with a substance use disorder counselor from a treatment clinic, and discussed homelessness with the CEO of a non-profit organization serving unsheltered people.

The final exhibition for the political campaign was a debate in the council chamber at San Marcos City Hall. Students responded to questions from a debate moderator, as well as questions from audience members. For the oral history project, students presented their book in an exhibition at the San Diego History Center. The people they interviewed came to read excerpts from the stories that students curated, and the students and interviewees participated in a Q&A panel about their experiences with the project.

How have people used the night sky to make decisions in other times and cultures?

How do people use nature to connect to themselves, each other, and the environment? Are public parks a luxury or a necessity?

In early 2019, an impasse on the federal budget led to the closure of national parks. Eighth graders were curious and passionate about how the shutdown was affecting the parks and the role of parks in people's lives. Students explored how people use parks to connect to themselves, each other, and to nature. Students used the design thinking process to create a product that preserved and enhanced a local, state, or national park. They visited various parks to do field work for their products and wrote about "peak moments" that often occur when humans are immersed in nature.

STARS IN THE PARKS

BRITTANY PERRO • CHRIS OLIVAS • CHARLEY JACOB

EIGHTH GRADE

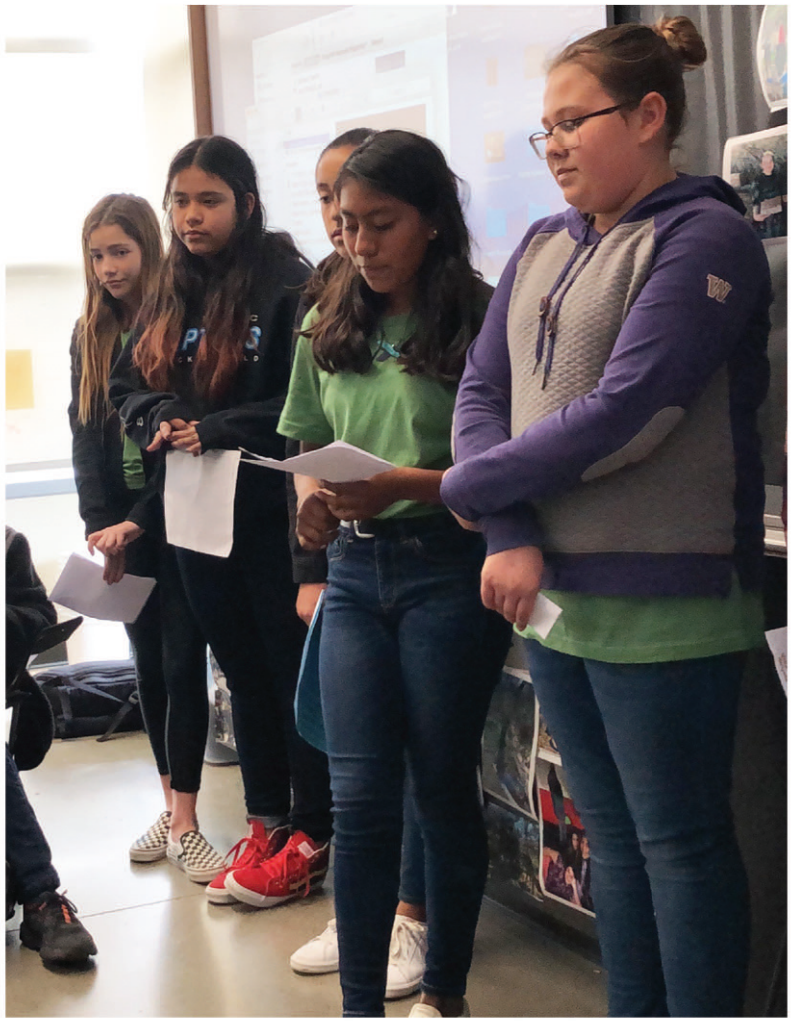
HIGH TECH MIDDLE NORTH COUNTY

The project launched with a trip to a state park, where students established their first relationship with park rangers who spoke about their needs. Two of the park clients wanted the students to help develop products that would encourage and teach users about enjoying the parks at night. That dovetailed perfectly with Chris Olivas's passion for astrophotography and his desire to teach about astronomy, light, and photography.

The team came up with a rough list of potential products based on their clients' needs. Students responded to an interest survey, and wrote "job applications" to be on various product teams.

LEARNING GOALS

- To understand the Earth/Sun/Moon relationship, the scale of the universe, gravity, Newton's laws of motion, light, and the electromagnetic spectrum
- To learn exponential expressions, scientific notation, and doing scaled drawings/designs
- To understand the politics behind national, state, and regional parks, and how citizens can use writing to engage in the political process
- To experience immersion in nature while reading literature about immersive nature experiences
- To learn and practice the iterative design thinking process with a real client



DESIGN THINKING

The project was structured around the design thinking steps of empathize, define, ideate, prototype, test. During visits to the parks, students observed and interviewed rangers about their park's needs. They came up with solutions, prototyped them, and received feedback from their clients. Products resulting from the design process included:

- A hiking trail informational kiosk
- A scale model of the solar system for a hiking trail
- "Remixed" park emblems for "Park After Dark" events
- An infographic about the "dark sky community" guidelines to be posted in campsites
- A curriculum for teachers and rangers to use on overnight camping trips about the night sky
- "Leave No Trace" signs for the Anza Borrego flower fields
- Night sky astrophotography

While each group of students focused on a product for a different client, all students engaged in reading and writing about nature and the history of national and state parks. The whole class read John Krakauer's *Into the Wild* and debated the beauty and pitfalls of nature, as well as the mental health mysteries and issues raised by the book. Writing products included essays arguing whether national parks are a luxury or a necessity, and a composite essay entitled "Dear National Parks" that combined each student's favorite moment in the parks, which was shared with Kamala Harris, who was then a U.S. Senator.

SCAFFOLDING AND DIFFERENTIATION

Many of the texts used for the project were challenging for eighth graders. The teaching team used a variety of scaffolding techniques for close reading and writing– including graphic organizers, close reading steps, sentence starters, partnered text translation and analysis. Brittany and Chris created multiple opportunities for self-assessment, through writing and editing rubrics and assessments of prototypes. According to Brittany, the biggest change in students may have been in their understanding of how they could make an impact. At the start of the project, many voiced frustration about neglect and vandalism of the parks, but had a sense of "Yeah, but there's nothing we can do." By the end of the project, they saw how small acts, such as reducing light pollution, cleaning up parks, and advocating with elected officials can make a difference.

EXHIBITION

At an evening school exhibition, students showed their design process and products; they created stations about particular research topics, such as the dark sky communities movement. They recreated the side of the bus from *Into the Wild*. One group created a film about young people connecting with nature and created a virtual campfire using video projection.

After the exhibition, the groups presented their products to their park ranger clients, and spent a service day working in one of the parks.

“How do we make informed decisions about the food we eat?”

The inspiration for this project came from Mari Jones seeing a need for change in the way students were eating and in the amount of food they were wasting each day. The goal was for students to learn to think critically about all aspects of food. Throughout this year-long project, students used the subject of food to talk about community, family traditions, sustainability, and health.

The project launched with a connection between food and community. The class had a feast to share food that was meaningful to them and visited the local Children’s Museum exhibit about food.

This project lasted throughout the school year and had several distinct parts. The first nine weeks were dedicated to three questions: Where does our food come from? How has agriculture changed over the years? How does our food affect the environment?

Students examined California history through the lens of agriculture and began to grow their own food in the school garden. They wrote letters to the editor from the perspectives of farm workers and farm owners. They also created comics to represent an era in California’s agricultural history. They considered facets of present-day food production and distribution, including organic, genetically modified organisms (GMO), locally grown and imported foods. Research sources included many nonfiction books, as well as interviews with local farmers and a local fisherman who spoke about sustainable fishing practices. Students wrote opinion pieces about the complex choices involved when purchasing fruits.

The next part of the project was about health and choices. These seven weeks were dedicated to two questions: How does the food we eat affect our health? How does advertising toward children affect their perceptions and decisions about food?

Students learned about digestion and nutrition, the difference between whole and processed foods, and the importance of a plant-based diet. They recorded food logs and wrote scripts in which foods spoke convincingly to an eater about why they should eat a particular food. They also learned about broader issues facing the nation due to poor diets. Students conducted research on the American diet as well as the diet of the students at the school. They surveyed the kinds of foods students were bringing to school, analyzed the data, and came up with recommendations, which they wrote up as a report and shared back with the community at an all-school gathering.

Guest speakers included a gastroenterologist and the caterers who provided the school lunch. In art, students created print ads using photography and hand drawn overlays to tell people the truth about the nutritional impact of some favorite (junk) foods. In science, they explored health problems and diseases that were food related. The class also visited a local grocery store to look at how the environment was subliminally selling unhealthy food to young people.

THE TRUTH ABOUT FOOD

FOURTH GRADE PROJECT

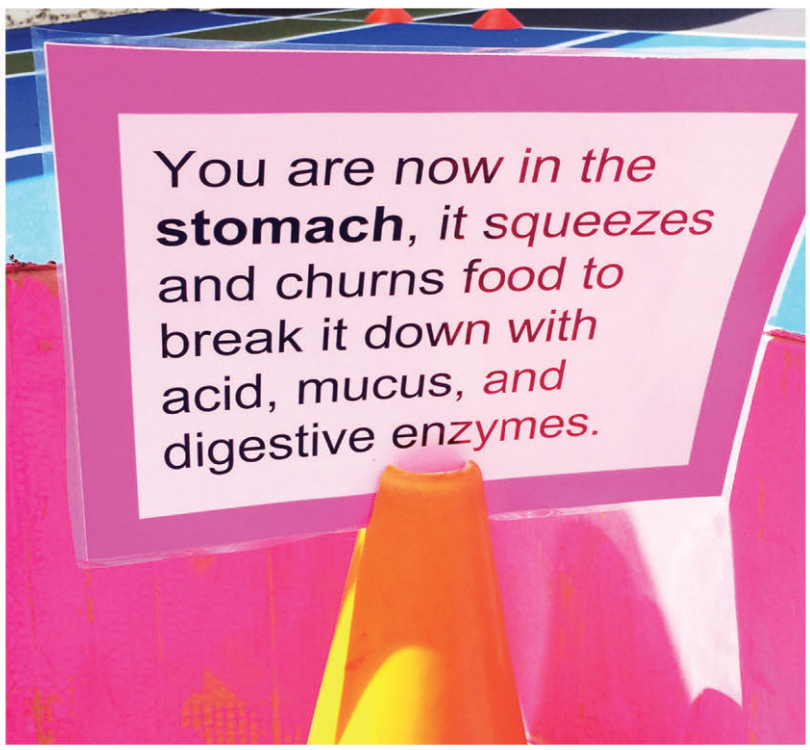
HIGH TECH ELEMENTARY EXPLORER

MARI JONES

The next three weeks were focused on food equity, exploring the questions: How is food different for different social classes in America? In the world? What is the hunger problem? How can we help?

By visiting an urban farm in a local food desert, students learned what a food desert is, and how people are trying to make changes to help people who live in food deserts. By reading fiction and nonfiction texts, watching news clips about inequality and hunger, students examined issues regarding food equity. They engaged in Socratic seminars, classroom discussions, wrote responses to literature, and volunteered at a local organization, Feeding America.

The final four weeks of the project were dedicated to planning and implementing a Food Day event for the school community. Students got into groups that focused on one aspect of food that they wanted to teach about. Each group planned and created their activities and displays for the guests. One group was in charge of event management, including contacting a local organic food truck, and inviting representatives from Feeding America. Students were in charge of planning, delegating, and breaking down tasks, as well as reporting progress.



LEARNING GOALS

Art: students will learn about the significance of food to the community, connecting their own experiences to ways that artists express their relationship with food. Students will identify elements of print advertising, and use these to create their own print advertisements to tell the truth about food.

Science: students will identify biotic and abiotic factors in the growing of food, identify parts of seeds and gardens, understand photosynthesis, and grow their own food. Students will also understand the role of each part of a food chain and food web. Students will identify what human bodies need to survive, how humans metabolize food, and will use this to draw conclusions about nutrition and healthy eating.

Social Studies: students will understand how California's food production and distribution have changed over time in the context of California history from the pre-Columbian era to the present day. Students will identify ethical issues surrounding food throughout history and present day, including the farmworkers movement and the presence of food deserts in marginalized communities.

English Language Arts: students will read and comprehend a variety of fiction and nonfiction texts related to food (and community, history, science, and current events). They will be able to draw evidence from literary or informational texts to support analysis, reflection, and research. Students will produce a variety of written pieces, including personal reflections, letters to the editor, comic strips, summaries, opinion pieces, scripts, and informative (research) texts.

Math: students will collect data about our school community's eating habits, will represent this data, and will analyze this data in comparison to the data about the American diet.

SCAFFOLDING AND DIFFERENTIATION

One of the most challenging aspects of this project was scaffolding the literacy components for students at varying levels of literacy development. Whole group shared reading and writing allowed Mari to model processes for students, followed by thoughtful pairings and varying text levels for reading and writing work.

EXHIBITION

The culminating event was inspired by Food Day, a national celebration that takes place every fall in communities across the country. The class decided to create their own Food Day for the school community, a combination of a fair, interactive museum, and exhibition.

Students were involved in creating the activities and using what they had learned throughout the project to inform the community. They formed groups that designed interactive booths about nutrition, the human body, food advertising, where food comes from, and hunger in America. Each booth displayed artifacts from their project work, as well as new products students created specifically for the audience experience at Food Day. At an information booth, students sold the magazines they had created and designed with various written products, as well as their print ads and comic strips. The profits from magazines sold went to support Feeding America, an organization they had volunteered with during the project.

"Can I just start off by saying... making a podcast is hard!"

Anna Nicole Barreiro, 10th grade student

In November 2016, the State of California had 17 propositions on the ballot, ranging from legalizing marijuana to ending the death penalty.

The 50 students in Alec Patton's tenth grade team were two years away from voting, yet many of them had never heard of the propositions on the ballot. Indeed, many California adults had never heard of them. Alec reached out to Voice of San Diego, a local news organization that agreed to air the student podcasts if they were good enough. Gimlet Media, one of the most successful podcast producers in the U.S., agreed to critique the students' podcasts. This had to be a quick project, as there were only eight weeks between the project launch and Election Day.

On back to school night, Alec set up a World Cafe* where each table featured a different proposition set in the middle of a paper tablecloth, and parents were asked to write the questions they had about the proposition on the tablecloth. The next day, the students also went from table to table looking at the same notes their parents had created, which generated lots of questions and opinions.

After this experience, all the students voted on what they thought were the most interesting propositions to work on, and they narrowed it down to four: Prop 57 (less prison time for nonviolent crimes), Prop 63 (restrictions on ammunition sales), Prop 64 (legalizing marijuana) and Props 62 and 66 (two competing propositions on the death penalty).

To model the process of doing background research on each issue, classes took an in-depth look at Prop 64 (marijuana legalization) together. Students read the proposition, and the official information provided by the state, as well as additional readings from California newspapers, then generated questions and arguments and discussed them in a Socratic seminar.

Students worked on their podcasts in groups of four. Three groups were assigned to each proposition, so that their podcasts could be combined into longer podcasts consisting of three "chapters," in the style of the popular podcast This American Life. At first, many students just wanted to do "pro" vs. "anti" podcasts. After several days listening to podcasts, however, they realized that doing so would not make for a very interesting story. They needed to find interviewees who would make their issue come alive. Students found interviewees ranging from a formerly incarcerated activist, a police chief in Colorado (where marijuana was already legal), a couple whose son had been murdered and whose remains were only found because his killer revealed their location in order to avoid the death penalty, and a doctor who ran a medical marijuana dispensary.

** World Cafe is a workshop/discussion format where multiple tables (cafe style) are set up with a paper tablecloth and each table has a particular topic, question, or dilemma to be examined. Groups rotate from table to table, discussing and posing questions. At each table there is a recorder who notes the discussion on the tablecloth, so that each subsequent group can engage with the previous group's thoughts.*

LEARNING GOALS

- To understand how a proposition becomes law
- To understand the potential consequences of state policy
- To learn to construct a compelling narrative about a controversial issue
- To learn to write a script
- To develop interviewing skills
- To learn audio and music editing skills

The students soon learned that the process of making a podcast is iterative, as the flow chart Alec created for the project illustrates. First they had to do background research and write a rough script, but their interviewees and the outcome of the interviews could often require them to dramatically re-write their narrative. Throughout the process, groups gave multiple peer critique to each other. Professional podcasters from Gimlet Media also gave feedback.

EXHIBITION

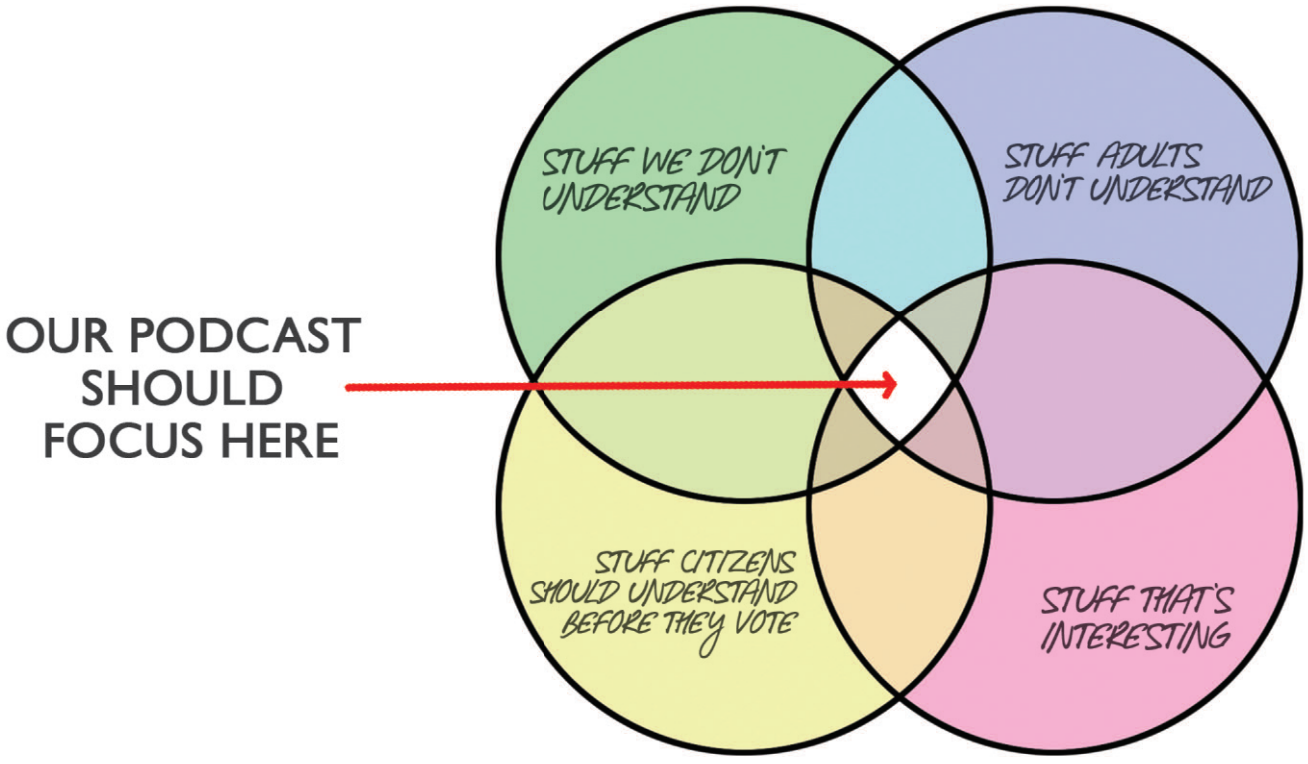
The production process came down to the wire, and students decided that they would rather create a better quality product than rush to get their podcasts made in time for Voice of San Diego to air them in advance of the election. So the exhibition took place the night before election day, at the OnStage Playhouse in downtown Chula Vista, to an audience of families, friends, experts, and interviewees. Each of the podcasts were played, and student panels responded to questions from the audience about the process and the propositions.

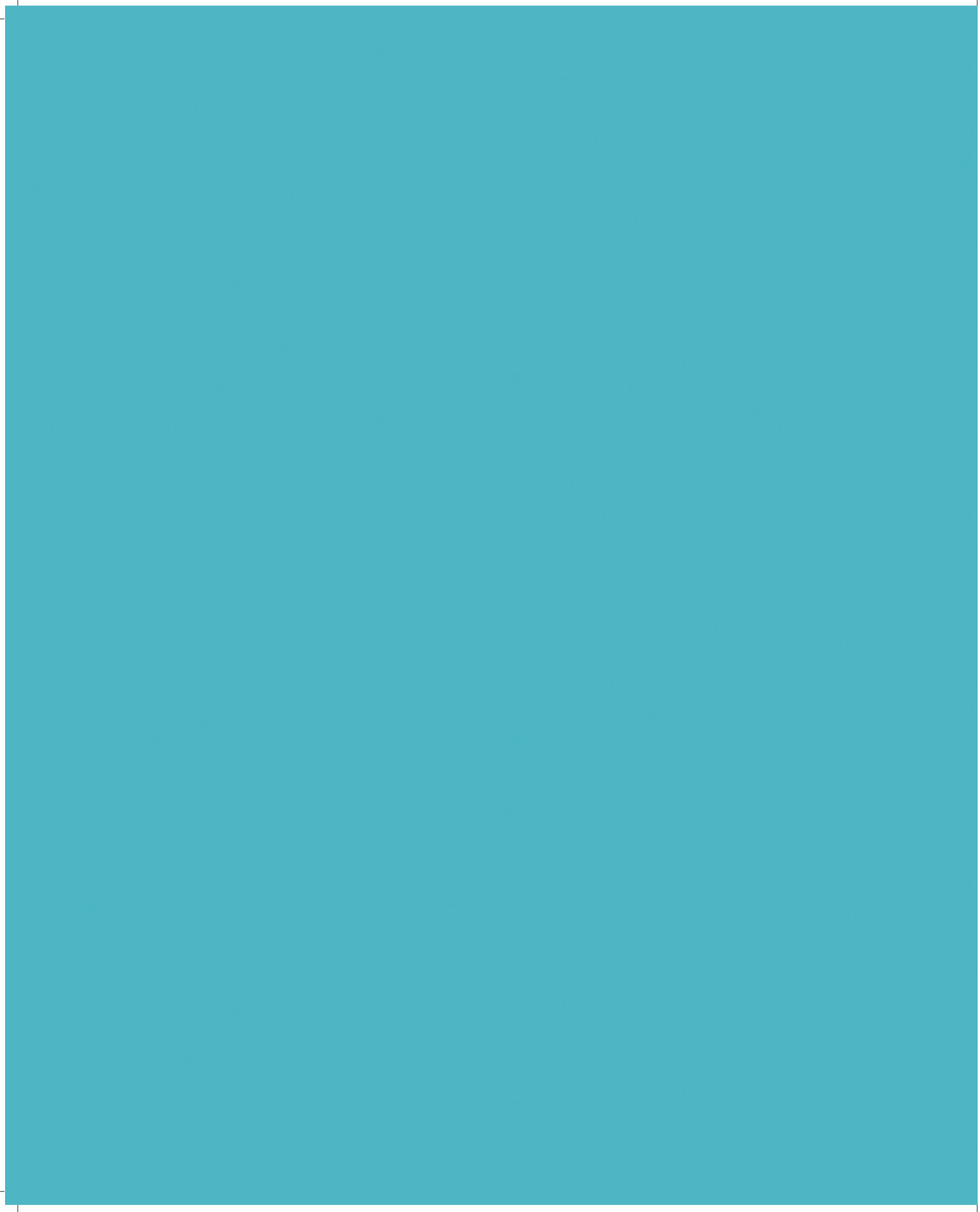
MAD PROPS PODCAST PROJECT

ALEC PATTON

TENTH GRADE HUMANITIES

HIGH TECH HIGH NORTH COUNTY





WITH EACH OTHER

In these projects, students are investigating their beliefs and relationships and changing them.

THE LIGHT OF KINDNESS

FREE YOUR MIND: THE ULTIMATE ESCAPE ROOM

IN SICKNESS AND IN HEALTH

NATURE OR NURTURE

THE SYRIAN REFUGEE SIMULATION

DRIBBLE AND REBEL

TOGA NIGHT

AMPERSAND: THE STUDENT JOURNAL OF SCHOOL & WORK

MODEL UNITED NATIONS TRADE WAR

READING BUDDIES: THE CHILDREN'S LITERATURE PROJECT

IMAGINE MURAL

THE WHOLE MEAL

“Always remember to light other people’s candles and let them light yours,”

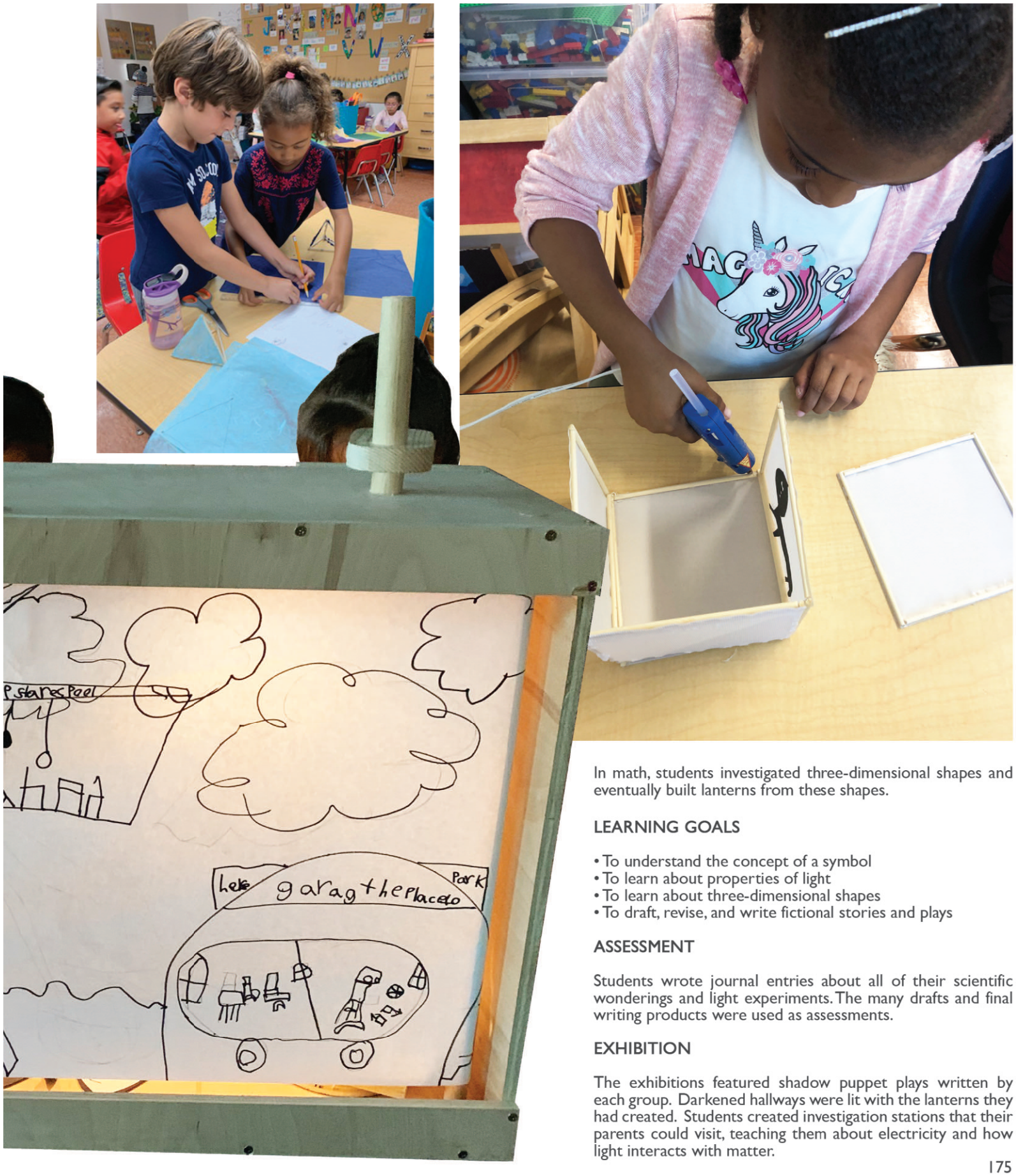
one of Dana Gaertner’s mentors often said. She and Patricia Lim wanted to explore both the literal and symbolic aspects of light and created a project with many phases and products. Science investigations allowed children to see how different materials are affected by a beam of light. Experiments involved reflections, shadows, opacity, being in the dark inside a cardboard box, and predicting if glitter or foil would sparkle without light. Students learned about electrical circuits and built flashlights.

THE LIGHT OF KINDNESS
DANA GAERTNER • PATRICIA LIM
FIRST GRADE
HIGH TECH ELEMENTARY EXPLORER
The light of kindness
How can you show kindness to others?
Give them a Spais
Sum body dy compliment
I can a honis a hus
Cah make Something for them
GIV A Pisit to A Prsin
Yu
giv a
You could give them a hug.
You can help suble up swuh who fel.
me one is lonley youcan ask them if thay want to play with
AY WIF THUM.
smoov your hows
to
inv a frend
Giv u pets

Students wrote fictional stories that featured characters bringing "light" in the form of kindness or joy to each other.

Stories were joined together and re-written as plays to be performed with shadow puppets during the exhibition.

In the literacy components of the project, students discussed the idea of a symbol, and what light symbolizes. Many read alouds helped to provide context.



In math, students investigated three-dimensional shapes and eventually built lanterns from these shapes.

LEARNING GOALS

- To understand the concept of a symbol
- To learn about properties of light
- To learn about three-dimensional shapes
- To draft, revise, and write fictional stories and plays

ASSESSMENT

Students wrote journal entries about all of their scientific wonderings and light experiments. The many drafts and final writing products were used as assessments.

EXHIBITION

The exhibitions featured shadow puppet plays written by each group. Darkened hallways were lit with the lanterns they had created. Students created investigation stations that their parents could visit, teaching them about electricity and how light interacts with matter.

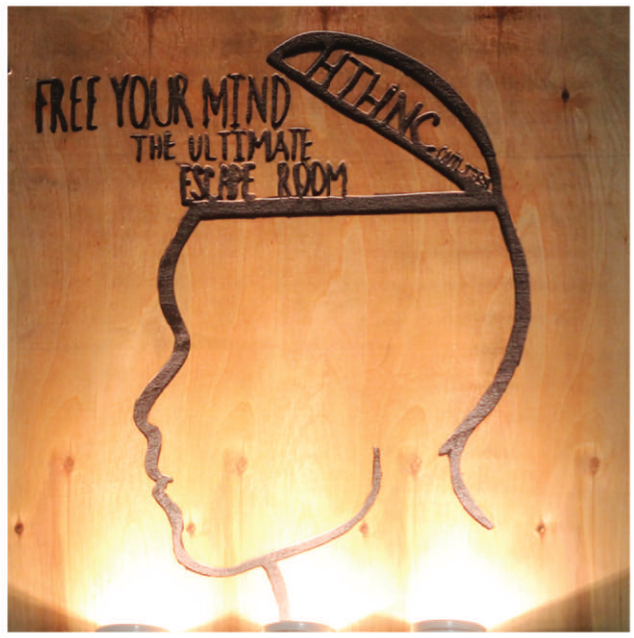
“Let’s unlock our psychic prisons...”

Back when escape rooms were all the rage, Michelle Pledger went to one, and thought, “What if the puzzles were about discovering and breaking out of our unconscious mindsets?” As soon as she told her math and engineering teaching partners about the idea, they were on board.

Students designed escape rooms that would challenge participants’ implicit bias by incorporating content related to attitudes about age, race, gender, sexuality, and mental health in each escape room puzzle. In order to escape the room, participants had to escape their own biases.

LEARNING GOALS

- To understand implicit bias
- To use literature, films, and interviews to understand how bias impacts people of different ages, races, genders, and sexual orientations
- To use evidence to support an argument in writing
- To use poetry, art, and film to express ideas
- To construct puzzles using coding
- To construct puzzles using circuitry
- To develop critique skills



The project launch consisted of a visit to (where else?) an escape room, to get students thinking about how they might design their own rooms. In humanities, students undertook a study of various kinds of bias, focusing first on ageism, through films, TED talks, reading, and visits to a retirement home where they interviewed residents.

They read *Kaffir Boy,* a memoir of growing up in apartheid South Africa, and discussed differences between explicit discrimination and implicit bias. Students took the Harvard Implicit Assumptions Test, and then read about its history and results to better understand research about unconscious bias.

Students used computer coding skills learned in math to design digital clues, and in physics and engineering, they applied design thinking and electrical circuitry to engineer electronic puzzles.

Each group chose to design their escape room around a particular theme of unconscious bias. Some were staged quite theatrically, such as an old-time casino that focused on gender bias, a jail cell setting that included puzzles about race and criminal justice, and a transgender-themed escape room that culminated in a “coming out” dinner party celebration. Students wrote reflective essays about their own unconscious biases and worked in groups to write a vision statement for each of their escape rooms.

The students created prototypes and puzzle flow diagrams, testing out their ideas on each other. They held multiple rounds of critique on both the mechanics and the concepts of each room. Students and teachers came up with critique questions collaboratively, such as “How do the puzzles connect to the implicit bias?” “How will the experience help the audience understand...” “How is coding used in the puzzles?” and “What is this group’s biggest challenge?”

In addition, students created art pieces in a form of their choosing, such as paintings, sculpture, film, poetry, and songs, that challenged participants’ implicit biases and stimulated dialogue.

Throughout the project, students engaged in difficult conversations with friends and families to identify their own biases, leaving them more empathetic and open-minded.

EXHIBITION

The team took over the ninth grade wing of the school, transforming each classroom into themed escape rooms. Outside the rooms, the students created a gallery where they exhibited art, poetry, and film.

FREE YOUR MIND

THE ULTIMATE ESCAPE ROOM

MIKE AMARILLAS • CATE CHALLEN
FELIX LOPEZ • MICHELLE PLEDGER
NINTH GRADE
HIGH TECH HIGH NORTH COUNTY

"What am I most likely to die of?"

This was a grim question to start a project with, but it certainly intrigued the 75 eleventh grade students who grappled with it. Through interviews with family members, scientists, and medical professionals, the students homed in on four main areas of disease to study.

For the next twelve weeks, they used art, biology, and humanities to pursue the essential question of "How can we take control of our health destinies?" The four major disease groups that had the greatest incidence among students' families also happened to be the ones that most medical research is devoted to: cancer, diabetes, neurological disease, and cardiovascular disease.

Biology teacher Matt Leader had worked over the summer in a University of California (UCSD) genomics lab with PhD candidate Danjuma Quarless. Through a National Science Foundation grant, they were able to invite researchers from various labs to collaborate. Researchers visited Matt's biology class every week to teach about what was currently known and unknown about these diseases. Various hands-on labs supported and made more real the information shared by these expert visitors.

Students tracked their own and their families' health behaviors over five weeks, and analyzed and wrote about the results. Based on this research, as well as their research into their family medical history, they wrote preventative health plans for themselves and their families, including recommendations for food and physical activities.

In humanities, each student recorded an oral history interview with a family member about a disease that had affected the family. Students then edited the interviews and added visuals to create a video on iMovie.

LEARNING GOALS

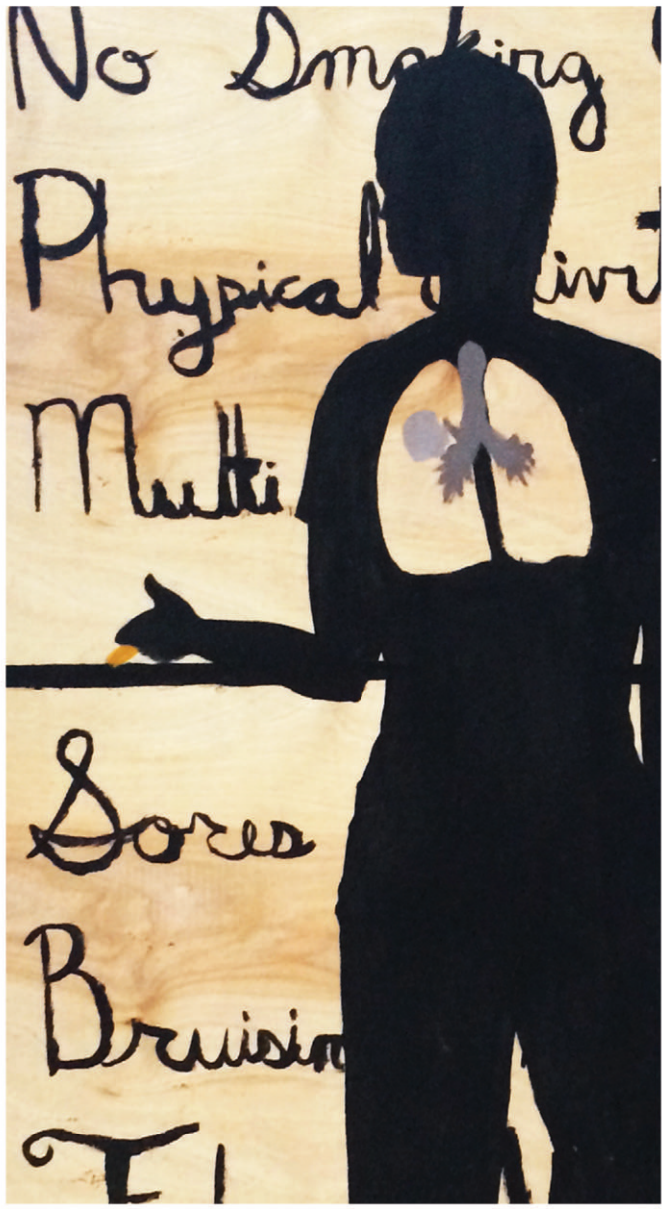
- To understand the scientific basis of diabetes, cancer, neurological and cardiovascular disease
- To write and follow a five-week preventative health plan
- To create a compelling video based on family history
- To use visual arts to express ideas about health and society

In art, students created multiple pieces around the themes they were studying. They created "Pieces of Me" triptych paintings expressing their identity, history, and biology. One of the visiting researchers, David Goodsell, was a molecular biologist and also a painter, who painted the cellular manifestations of disease. From him, the students got the idea to make cellular paintings. They also decided to interview the scientists that they connected with and ask them, "How would you visualize what you do?" The students translated these answers into large group paintings that were commissioned by and eventually gifted to the participating labs.

EXHIBITION

The students created four main areas of the exhibition, each corresponding to one of the four disease groups. In each section, they displayed paintings, writing, and listening stations with their oral history videos. They also re-enacted their favorite labs, so that attendees could have a hands-on experience dissecting pigs to find hidden tumors, or isolating a gene that caused a particular disease.

Danjuma hosted a second exhibition at UCSD. All of the graduate students and research scientists who participated, as well as others, were invited. The commissioned paintings that were gifted to participating labs are on permanent exhibition.

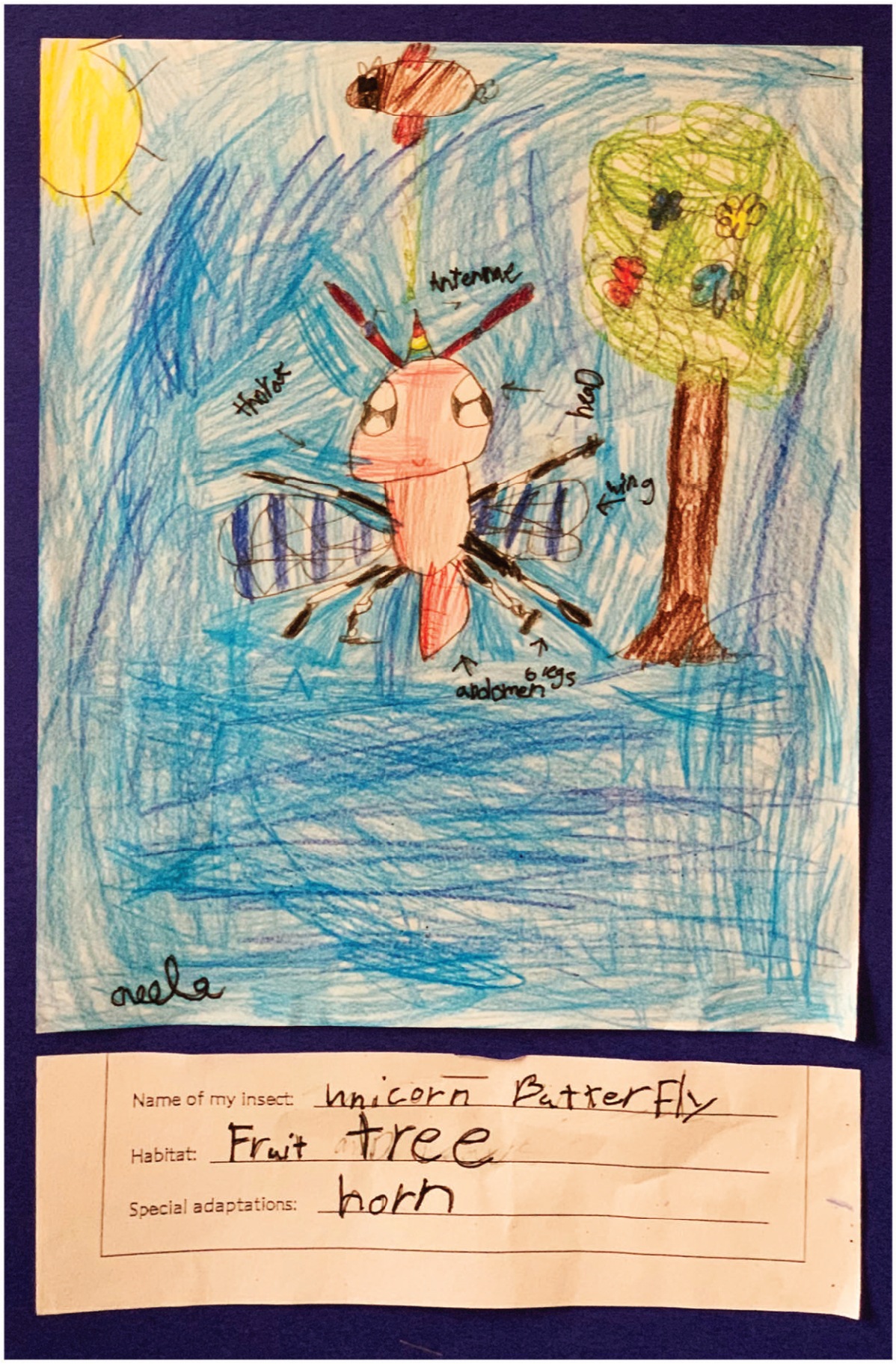


IN SICKNESS AND IN HEALTH

ALEC PATTON • SHANI LEADER • MATT LEADER

ELEVENTH GRADE

HIGH TECH HIGH NORTH COUNTY



Name of my insect: unicorn Butterfly

Habitat: Fruit tree

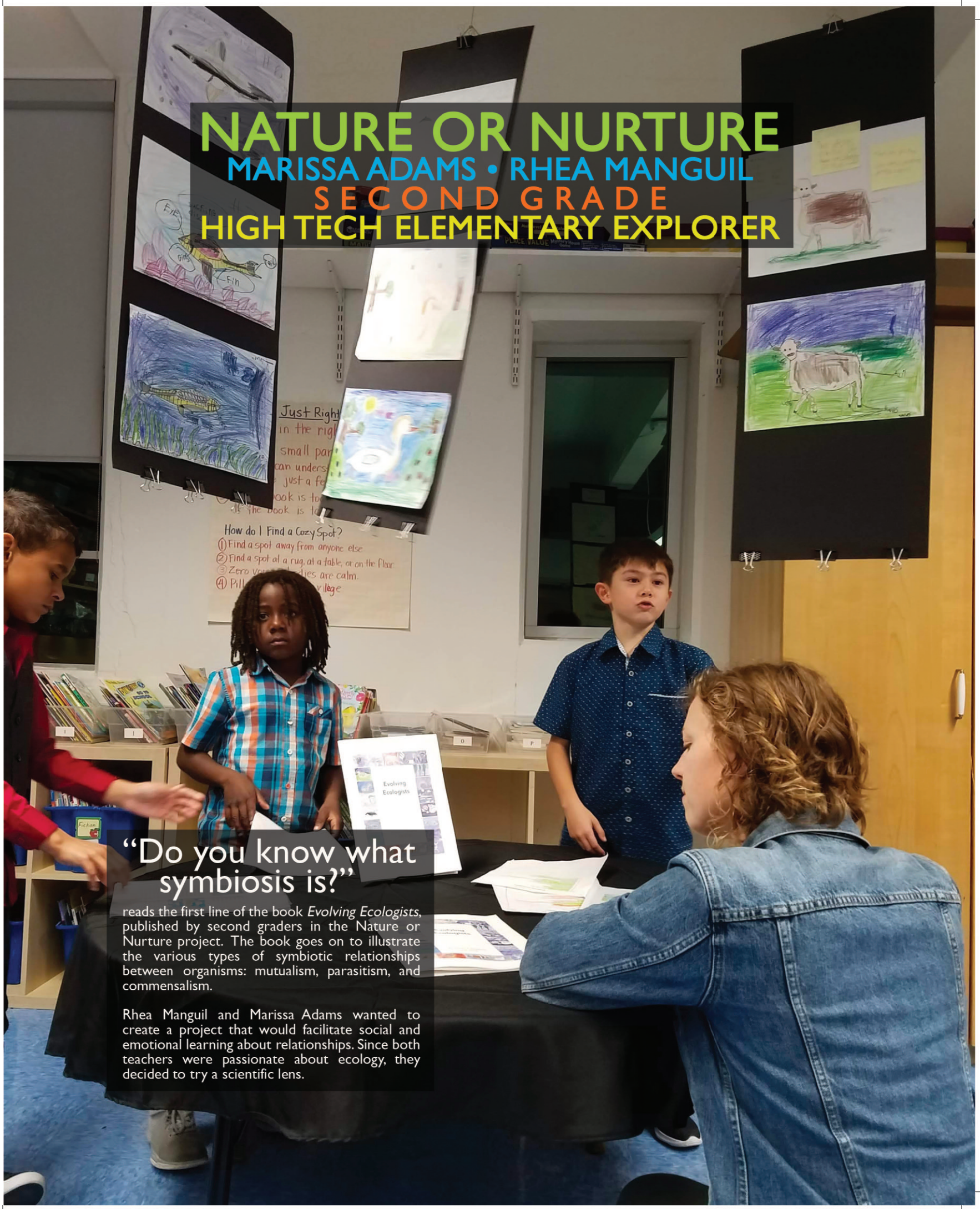
Special adaptations: horn

NATURE OR NURTURE

MARISSA ADAMS • RHEA MANGUIL

SECOND GRADE

HIGH TECH ELEMENTARY EXPLORER

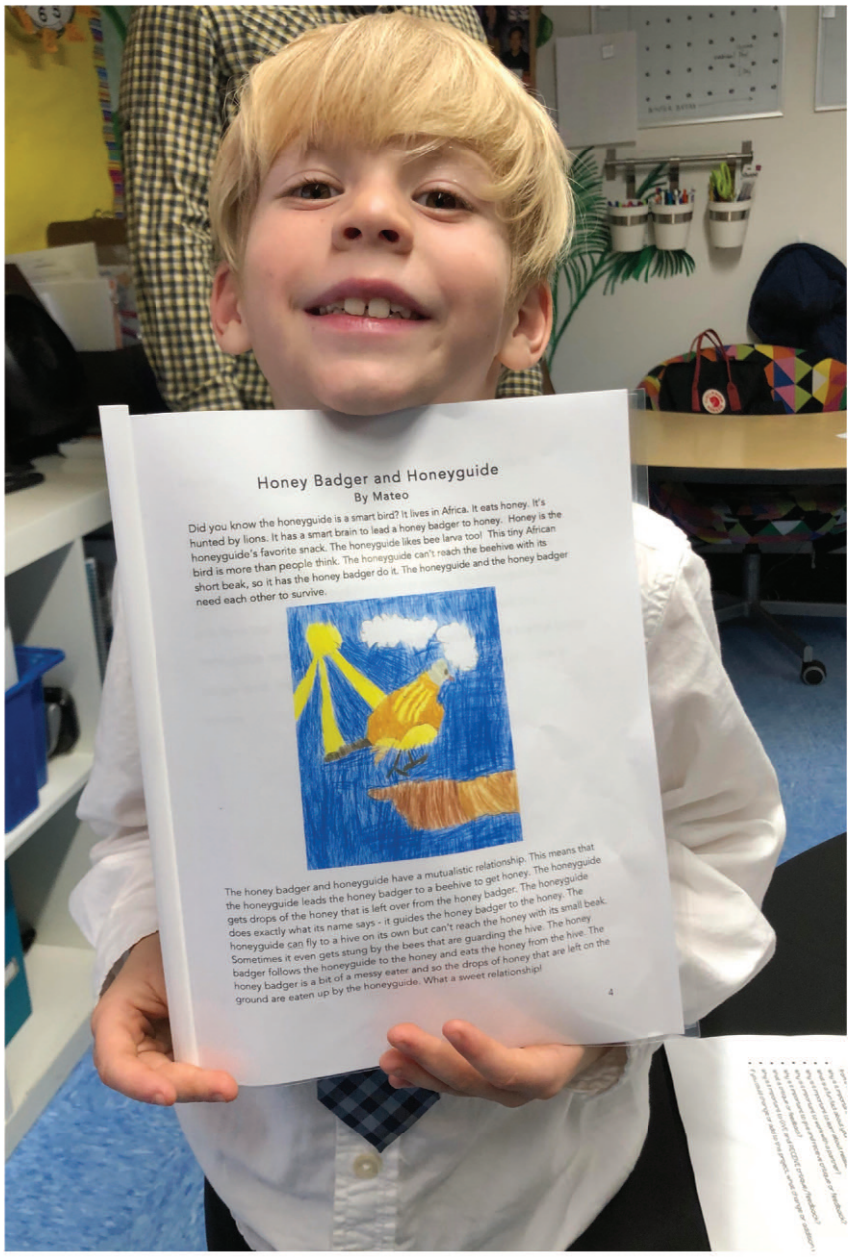


"Do you know what symbiosis is?"

reads the first line of the book *Evolving Ecologists*, published by second graders in the Nature or Nurture project. The book goes on to illustrate the various types of symbiotic relationships between organisms: mutualism, parasitism, and commensalism.

Rhea Manguil and Marissa Adams wanted to create a project that would facilitate social and emotional learning about relationships. Since both teachers were passionate about ecology, they decided to try a scientific lens.

Cards
Evolving
Ecologists
By Room 7 Students
Fall 2018



LEARNING GOALS

- To understand various types of symbiotic relationships amongst organisms
- To develop critique and revision skills in art-making
- To develop informational writing, editing, and critique skills
- To develop research and non-fiction reading skills

To launch the project, the teachers created a "Mystery Objects" slideshow, featuring images of intertwined animal and plant organisms. A guessing game ensued, which eventually led to the theme of relationships among living things. Field work for the project included outdoor observations and a trip to the zoo, where zoo educators taught the students about some of the relationships among the animals.

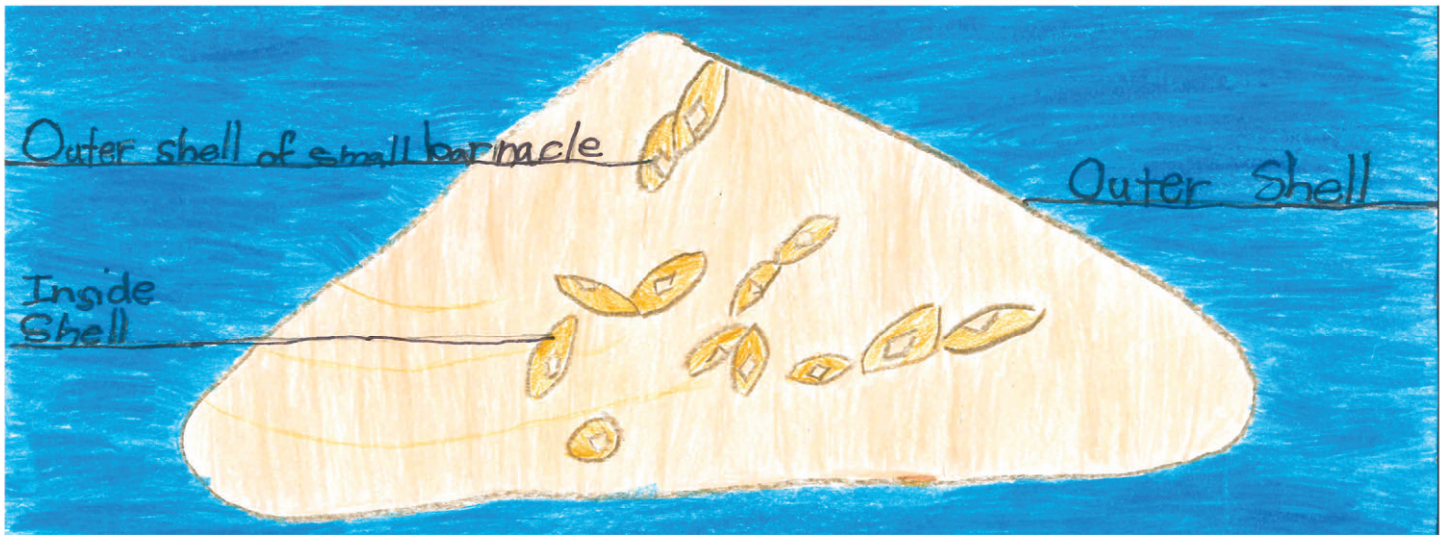
Each pair of students focused on a specific relationship in nature, such as bees and flowers; barnacles and whales; or cattle egrets and cows. They researched the relationship, wrote about it, and drew scientific drawings of each species. The final product was a book describing each species and its symbiotic relationship with another.

CRITIQUE

Revision and critique was an important part of this project. The class watched Ron Berger's "Austin's Butterfly" video many times, to learn how to give kind, specific, and helpful critique. Students made multiple drafts of their scientific drawings and were gratified to see their improvements.

EXHIBITION

The final exhibition featured copies of the published book, as well as displays of multiple drafts. Since critique was such an important part of the process, the teachers saved post-it critique notes and displayed those along with the drafts to showcase the evolution of the art work. Students also videotaped short responses to questions about relationships and critique using the app FLIPGRID to show their learning.



"I was struck by how many in between places I found myself stuck in. There were points where I don't think I was technically in any country, and I wondered where I was going to end up. I felt desperate and powerless." *Simulation participant*

In this student-created and student-run simulation, participants took on the roles of Syrian citizens forced to leave their homes and seek refuge in another country.

Participants physically moved through the simulation from station to station, starting in Raqqa, Syria, where they were given their character information and their papers. This briefing was interrupted by ISIS members.

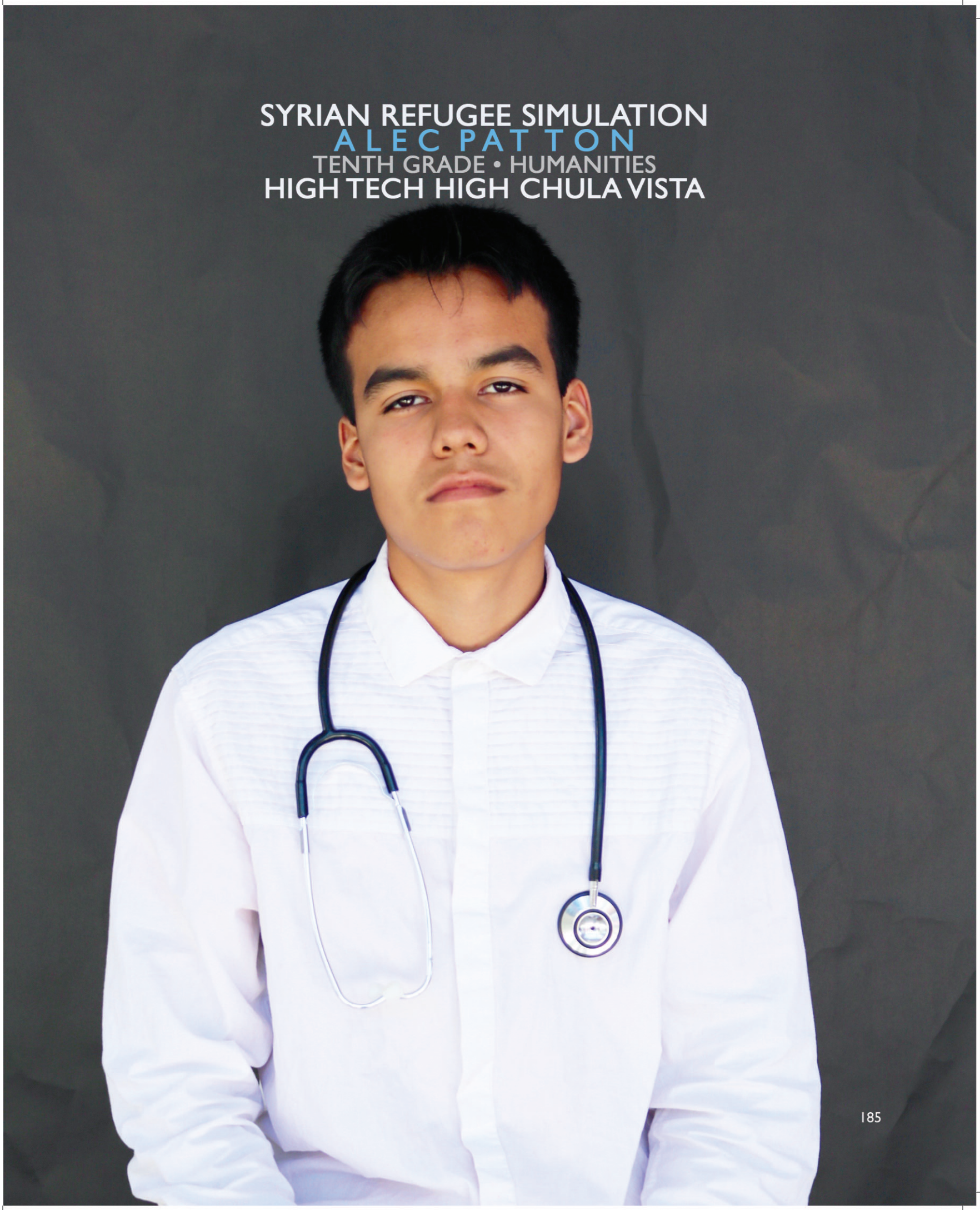
From here, participants had to sneak across the border to Turkey, get to a refugee camp, and decide whether to apply for resettlement overseas or pay a smuggler who promised to get them to Greece. At each station, characters based on real people were there to help or hinder their passage, and each of these characters had a story to tell.

LEARNING GOALS

- To understand the historical context of the Syrian refugee crisis
- To understand the international laws and institutions that govern refugees
- To understand the process that refugees go through to seek sanctuary
- To read complex texts in order to find specific information
- To distill research into short, informative writing pieces
- To write compelling character and situation narratives
- To learn game design and testing
- To collaboratively plan and execute a complex event

SYRIAN REFUGEE SIMULATION

ALEC PATTON
TENTH GRADE • HUMANITIES
HIGH TECH HIGH CHULA VISTA



As a humanities teacher and coordinator of a Shakespeare club, Alec Patton had put on many plays with students, but never a role-playing simulation. At the project's beginning, he still hadn't decided whether the final exhibition would be a play or a simulation. He got together with some students who planned a project launch: Alec stood up in front of the class and announced a pop quiz, while a group of black-hooded intruders quietly entered from the back, then seized control of the class. They announced that students had to make a choice: stay under their new regime, or flee, and then explained this was what it would be like for their participants if they decided to design a simulation.

The project began with common readings about Syria, the refugee crisis, and some powerful journalistic accounts of refugees' journeys. At the same time, the team explored simulations and role-playing games. Many of the students were far more expert than Alec in these; they told him about a video game called "This War of Mine," in which the object is to survive the siege of Sarajevo, which seemed like it could serve as a rough model for what they hoped to create.

After the students gathered some background information, small groups were each assigned an article about an individual refugee's journey. They were tasked with annotating and mapping each step of the journey geographically, and what decisions they were faced with. Each group brought their refugee's story to a class-wide mapping session in which all of the paths were mapped out on a giant whiteboard. The class could then step back and look at which routes were most heavily traveled.

The mapping process led directly to the game design: once the students had decided upon the most common stops and the decisions faced at each step of the journey, they divided themselves into station groups. For each station (such as the Turkish border, or a refugee camp), students created maps, decision tree diagrams, character narratives, and narratives describing context, institutions, and laws.

As the students developed their stations, they ran intensive playtests (simulation practices), critiques, and revisions. Finally, they were ready for a full simulation playtest, final revision, and exhibition.

EXHIBITION

The group was lucky to have more than one opportunity to run the simulation. The first took place at the school-wide Fiesta del Sol, where families, community members, and K-12 students participated. A second took place for students at another HTH campus. At the end of the simulation, students set up de-briefing stations, where participants could share their responses and ask questions about the content and the process.

"How do athletes use their positions of power to make change?"

The fourth grade team had gotten to know their students in the prior semester, and they were a sporty and active bunch. The teachers designed a project to look at history through the lens of sports and to explore how sports build and shape communities.

Readings highlighted specific athletes, and these profiles were used to look at the historical contexts of the period. Topics ranged from the segregated baseball leagues, to women in sports, to the origins of American football in residential schools for Native Americans. Every two weeks, the group focused on a different aspect of identity, such as race, gender, or disability, so the students looked at multiple periods of history from different perspectives.

The team launched the project with a grade-wide (75 students) collaborative game. After the game, the whole group reflected on how sports can help build community. At one point during the project, students saw a Microsoft Superbowl advertisement for an adaptive game controller with the tag line, "when everyone plays, we all win." Discussion of the tag line led the students to the idea of an all-school Olympics Day.

Based on their interests, students divided themselves into committees: a refueling group wrote letters to local businesses to solicit donations of fruit and water; a design group created a logo and designed and screen printed t-shirts; a game design group planned games and tested them out with classmates (the whole grade voted on the final games); another group surveyed each teacher in the school and created multi-age teams that would work well together.

LEARNING GOALS

- To write opinion pieces on topics or texts, supporting a point of view with reasons and information
- To explain events, ideas, or concepts in a historical text, including what happened and why, based on specific information in the text
- To integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words
- To understand social justice movements in the U.S. through athletes' life stories and the history of sports
- To work collaboratively to plan a complex event

Throughout the project, students wrote journal entries in response to readings, field work, and discussions. They visited and interviewed women's basketball and soccer players at a local university, as well as a member of the USA Blind Hockey Team. They used their journal reflections as raw material to write an opinion essay and spoken word poem about an issue they felt strongly about.

In art class, fourth graders were studying how artists as well as athletes have used their voices to make social justice statements. They visited Chicano Park in San Diego and learned about the history of the murals there and the Chicano rights movement. They studied the origami murals of Mademoiselle Maurice, and created a similar style mural to be installed on the U.S./Mexico border. To choose the words for the installation "TU ERES MI OTRO YO," the whole grade held a community meeting in which they reviewed the project and came to a consensus about their message.

EXHIBITION

Fourth graders planned the Olympics Day, in which the whole school and many parents participated. At the opening of the Olympics Day, students performed their spoken word poems. One of the stations was a sports museum, where students displayed their writing about the history they had studied. The large origami mural was installed on the U.S./Mexico border at Friendship Park in Tijuana.

DRIBBLE AND REBEL

CELINA GONZALEZ • CLAIRE GRESHAM
ANYA ROSENBERG • KARI SHELTON • RINA VINETZ
FOURTH GRADE
HIGH TECH ELEMENTARY NORTH COUNTY

Freshman actors who performed both male and female parts in *The Trojan Women*

"The best part would be the play."

Mark Aguirre's inspiration for this project came from an academic talk that he attended on the connection between *The Iliad* by Homer, *Median Dialog* by Thucydides, and *The Trojan Women,* a play by Euripides. These three texts show an early civilization evolving from iron age brutality to a society with ideals about justice and empathy. "I thought I could adapt a study of these three texts for ninth graders, and the best part would be the play."

The challenge was to get through these three dense texts with students who had widely varying levels of reading comprehension and maturity. The students were paired up, with each partner responsible for a small part of the text; this enabled them to help each other paraphrase their portions of the text so that everyone could understand the meaning.

Utilizing a form of Socratic seminar, the students worked together to analyze the subtext and look at what these stories revealed about the societies that produced them. Guided by these plays, discussions ranged from religion, to the discovery of math and science, to the morality of war. With each discussion, students connected the themes to current world events.

The class started with *The Iliad*, reading in teams and translating the meaning into modern speech. They continued with the *Median Dialog*, unpacking the humanistic growth of Greek society, and finally reading *The Trojan Women* aloud in class. The students decided to have the boys perform that play since in ancient Greek times, the audience and actors were all men.

The girls in the class wrote an adaptation of *The Trojan Women* following similar themes of genocide, war, refugees, and the treatment of women. There were many settings to choose from, such as the Holocaust, the killing of nuns in El Salvador, or the French Revolution.

Mark created a list of jobs: Director, Actors, Set Decorators, Lighting, Costumes, Publicity, and Writers. Many students had dual roles, which helped with communication and coordination. Mark's goal was for students to have multiple jobs, some that fit with their interests and skills and at least one that challenged their concept of themselves.

LEARNING GOALS

- To break down a challenging text and explain its meaning to others
- To gain a perspective on ancient history and its parallels in modern history
- To consider questions such as, "Does might make right?" and "Is it possible to be victorious and empathetic?"
- To learn to manage time and human resources to create a professional performance

ASSESSMENT

"I don't give them a test. I ask the students individually to tell me what they know." Mark used "Coffee Talks" every morning, in which students applied something from the news to their stories. "How does U.S. policy compare to Agammemnon's foreign policy?" Finally, each student kept a portfolio for assessment. The students were able to keep fixing and revising the work in their portfolios until they felt satisfied with the grade they had.

SCAFFOLDING AND DIFFERENTIATION

The considerable time spent paraphrasing the texts helped make them accessible to all students. Everyone presented what they found in the text. Students worked in teams and sometimes one-on-one with a teacher to understand a story and its connections to the greater theme. Student growth, understanding of the stories, and ability to explain the underlying concepts were supported individually.

TOGA NIGHT

MARK AGUIRRE
NINTH GRADE • HUMANITIES
HIGH TECH HIGH

"Menelaus" performed by Pablo

"Cassandra" performed by Henry

“Could we make a yearbook of internships?”

Randy Scherer had been teaching eleventh graders, who took two afternoons a week out of school for an internship, for several years. He was looking to understand what students communicated about the relationship between school and the world of work, so that they could authentically integrate their internship experiences into their everyday learning.

Pursuing the question in his M.Ed research at the HTH Graduate School, he realized that in order to engage in deeper reflection, students needed to generate the raw materials by documenting their experiences in multiple ways. While at internship, they would take photos, interview their mentors, maintain an online journal, and give a presentation of learning.

Initially, Randy proposed to his class that they bring all of this together in a class website with photos, interviews, documentary video, etc. The students were not impressed.

One student, Sydney Lampe, raised her hand, and asked, “Could we make a yearbook of internships?” Intrigued, Randy pressed for more, and she explained that since they had been separated for this time, and not with their friends, what she really wanted was a book that captured everyone’s experience so she could see it, and they could remember it. “Obviously, I was in,” said Randy.

LEARNING GOALS

- To think critically about the role of work in life
- To develop interview skills
- To develop non-fiction writing skills
- To learn photography skills
- To learn to edit for publication

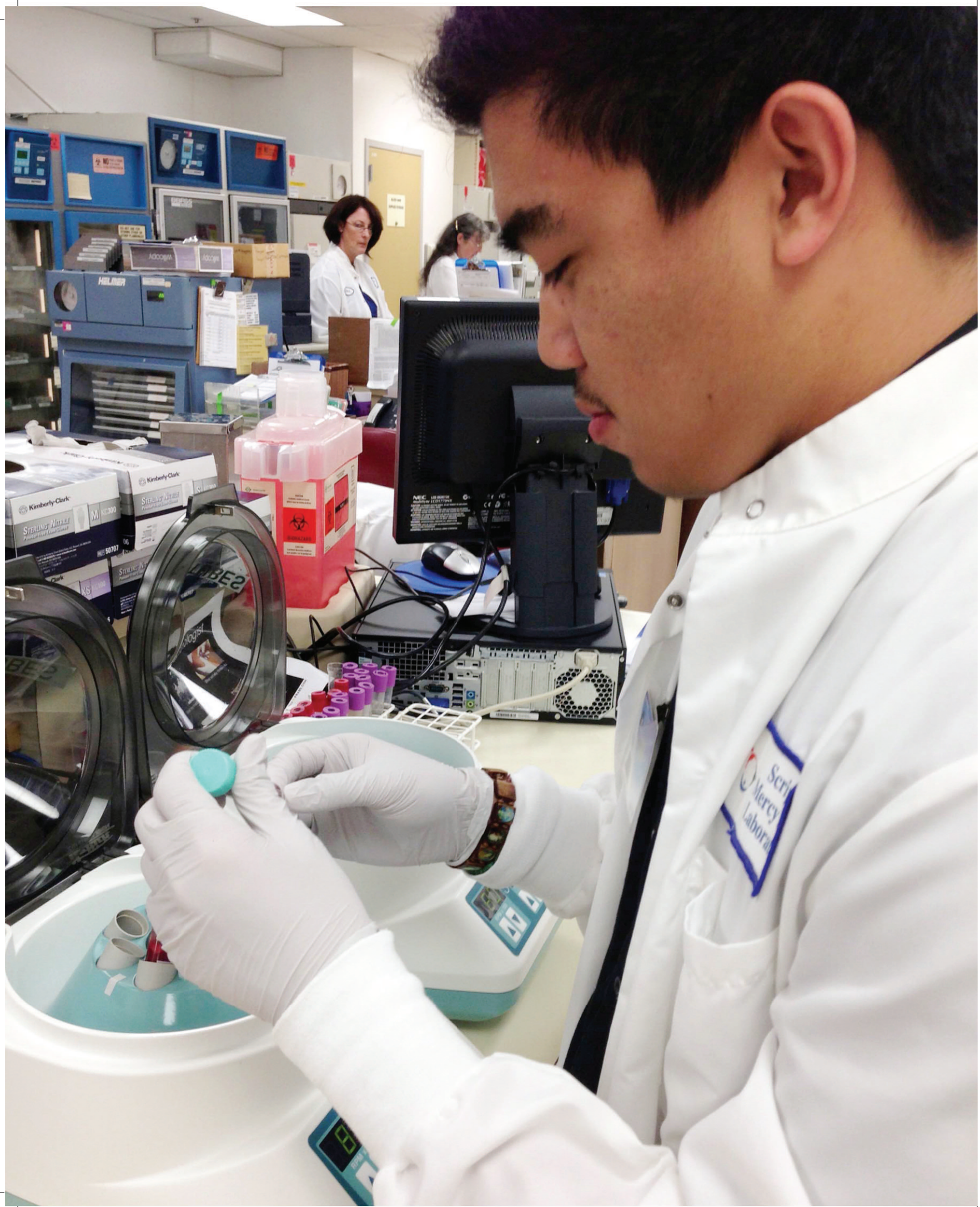
AMPERSAND

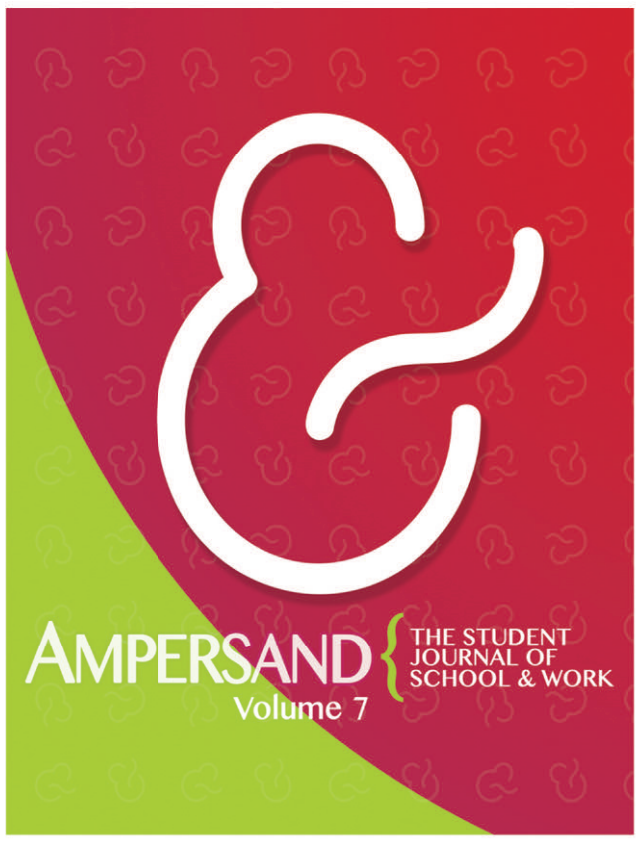
THE STUDENT JOURNAL OF SCHOOL & WORK

RANDY SCHERER

ELEVENTH GRADE • HUMANITIES

HIGH TECH HIGH MEDIA ARTS


HELMER
Kimberly-Clark
STERLING NITRILE
Scri
Mercy
Labora



During the internship, the main requirement for students was that they develop a project at their work site and complete it. To facilitate deeper reflections, Randy designed several mini-projects:

• An internship blog—each week, students responded to two or three prompts, such as: "What's most surprising about your internship so far?" "What is the culture of your workplace like?" "What challenges are you facing in your project?" " What do you appreciate about your mentor?"

• A photo essay—students took photographs of their workplace, which they would later edit down to a series of five emblematic photos, each accompanied by 200-word captions, that, together, told a story. When students returned from their internship, they critiqued and revised these, and shared them with their parents and the community.

• An interview with their mentor—students recorded an interview with their mentor, which they would later edit and revise for publication. Randy provided students with interviews from *Rolling Stone* and other national magazines. Students acted as journalists, illuminating stories of careers, education, and life outside of school. Students learned how their mentors chose their colleges, how they established themselves in their career, and in many cases about cross-country moves, parenting, and more. In subsequent years, Randy also gave past examples of students' interviews. Soon after students returned to school from their internship, they transformed these into professionally-styled news interviews, and published them online for their parents and the community.

• An internship presentation of learning—each student presented what they learned through their internship project, along with photos and reflections to a panel of teachers, peers, parents, and their worksite mentor.

When the students returned from their internship, they spent the remainder of the semester producing their edition of *Ampersand: The Student Journal of School and Work*. Students surveyed each other's photo essays and interviews, and proposed personal topics and themes to pursue in their edition of the book, which tended to explore how identity, education, and careers intersect for each individual. The first class chose the title *Ampersand*, because they realized that in their exploration of life beyond school they were adding new elements to their identity.

EXHIBITION

Exhibiting student writing is a little different than exhibiting other project-based student work, according to Randy. Professional writers rarely exhibit their work in the way of a science fair or art exhibition, he notes. "But every day of the week, writers exhibit their work in books, magazines, newspapers..." The key to making student publishing a high stakes and professional undertaking is to have an authentic audience. At the end of each semester, the class held a book release party for *Ampersand*, where their families and mentors could get their copies of the books, listen to author talks, and learn the reflective and writing process the students experienced.

More importantly, after the first year, they identified three distinct audiences for the journal. The first audience, as Sydney initially pointed out, was the students themselves—they got a memento of their friends' individual experiences and reflections. The second audience was current and potential internship mentors—the reflections and interviews helped them understand students' struggles and strengths and prepared them to be better mentors for future interns. The final audience was rising eleventh graders, who read past years' journals, grounding them in what to expect and what was possible for their own internship experience.

As a first-year math teacher,

Adam Ko participated with his students and a collaborating teacher in Model United Nations. He felt like a fish out of water, struggling to integrate math into the revered international simulation where students represent countries and debate important global issues to form resolutions.

From that struggle came the inspiration to create MUN Trade War, a game in which students use math to model economic and military avenues of international engagement.

LEARNING GOALS

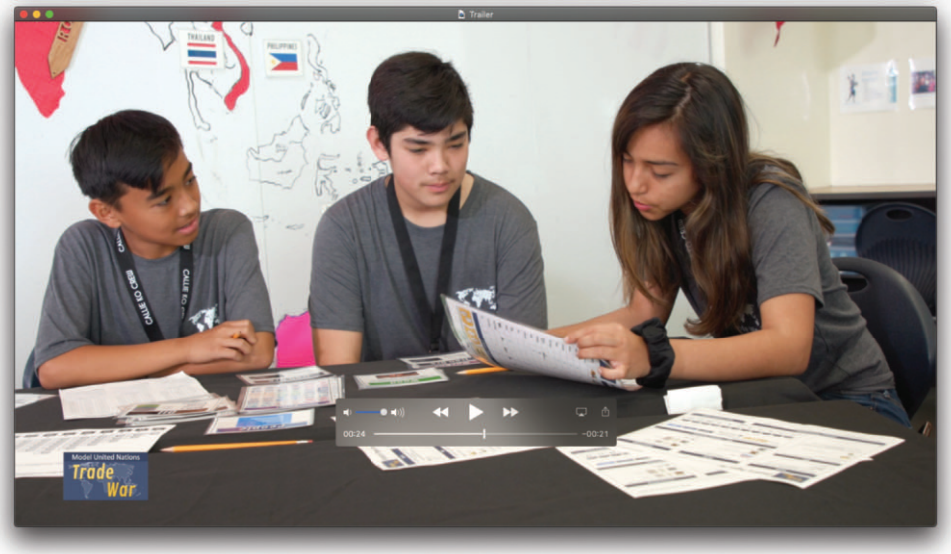
- To model real-world production percentages of important resources through dice probability
- To construct a scaled world map and learn about area
- To utilize angles to navigate roads and ships across the map to trade with allies or attack foes
- To make decisions about countries and manage resources and relationships in an interconnected world

Each student was part of a four-person team and had a group role that changed each round. These roles varied from writing trade agreements, describing decisions to build something or attack another country, or persuading countries to trade with them. Each role developed different skills and was designed to highlight students' varied strengths. The math problems derived from the project offered students many avenues to use evidence to arrive at an answer to a question that may not have a single, correct solution.

MODEL UNITED NATIONS TRADE WAR

ADAM KO • MATH

HIGH TECH HIGH CHULA VISTA



The trade war game often lasted for a whole semester. Adam's class played it twice a week, and direct instruction in math took place on other days, some but not all of which was directly relevant to the game. As the game progressed, new moves required new math content, such as angles to create shipping lanes or algebra to calculate the domain and slope of missile paths. The game provided motivation to learn the necessary math.

The game can be used in a stand-alone math class or can be integrated with humanities. One year, Adam collaborated with humanities teachers in a Building Governments project, where students designed a government based on democracy, theocracy, or aristocracy; their government's design then impacted their country's trading activity.

SCAFFOLDING AND DIFFERENTIATION

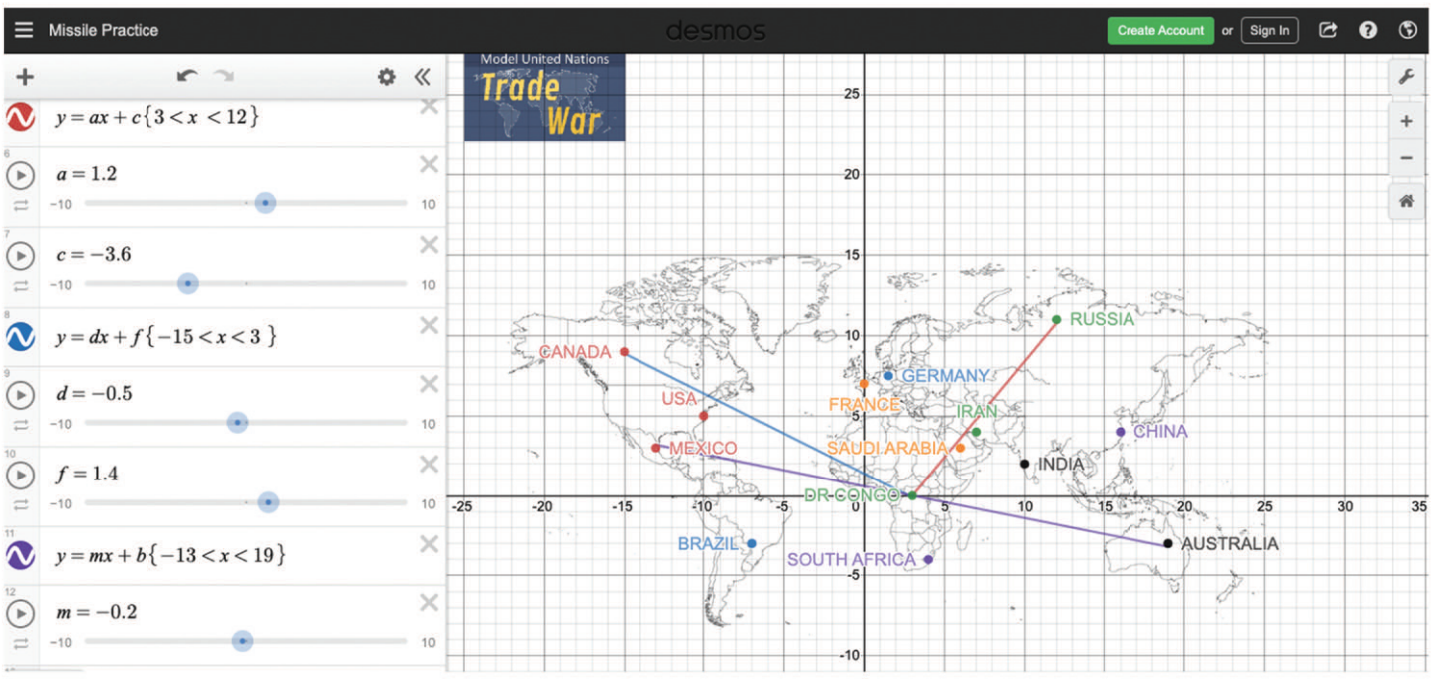
The game's multiple roles offer natural opportunities for differentiation. Adam recalls a student with an aide who could not fulfill all of the roles; with support, he was able to do one of the roles and thereby participated with his team. For students ready for more challenge, Adam introduced complexities such as calculations regarding circumnavigating the globe or missile parabolas taking into account the curvature of the Earth.

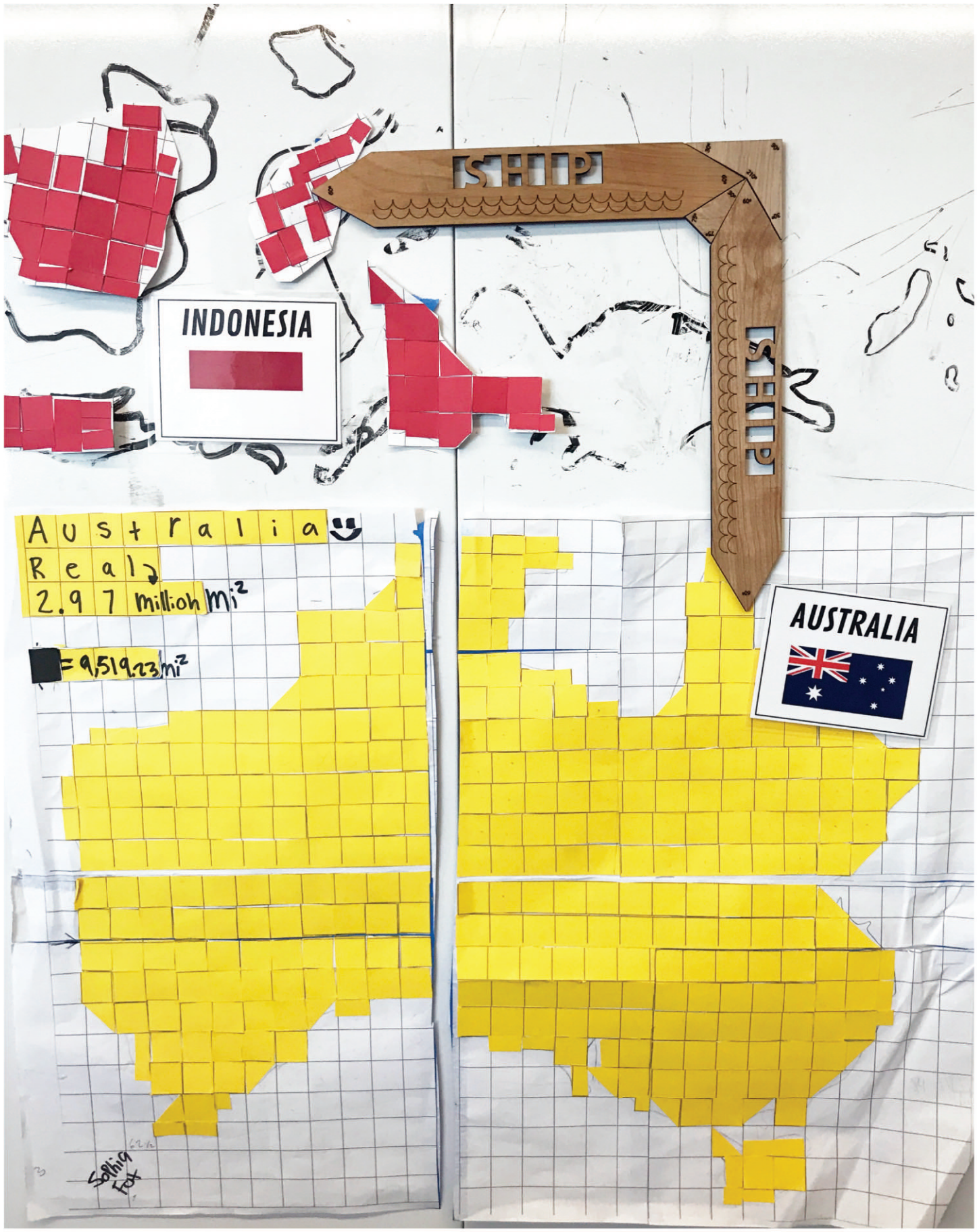
The fact that everyone participates is an important element; typically Model United Nations is offered in schools as an extracurricular activity, which primarily attracts academically or economically advantaged students.

EXHIBITION

How do you show your learning in a game? By playing the game, of course! On exhibition night, students taught their parents to play and coached them through the math, negotiation, alliances, and betrayals that ensued.

Adam's students have been playing the MUN Trade War for several years, and each year students' experience contributes to improvements. The game and many associated materials are freely available at muntradewar.com.




SHIP
SHIP
INDONESIA
AUSTRALIA
Australia
Real
2.97 million mi²
= 9,519,123 mi²

How do we learn to read?
How do we learn to love reading?

In the Children's Literature Project, each eleventh grader was partnered with a specific elementary student as a "reading buddy." They had three goals:

1. Help your buddy become a better reader.

2. Help your buddy love reading so much that they'll read on their own.

3. At the end of this project, you'll surprise your buddy with the gift of an original novel that is professionally published and available on Amazon.

As part of planning the project, the collaborating high school and elementary teachers met numerous times to create one-to-one partnerships between their elementary and high school students. They took into account social-emotional needs and strengths, interests, experiences as a reader, learning challenges, and emerging bilingualism. In some cases, they met with parents as well.

Whether they were avid readers or struggling readers themselves, the eleventh graders wrestled with questions such as, "How does one learn to read?" "How do concepts like 'decoding' actually work in the brain?" "How do readers make and correct common errors?" "What is a reading level and how does it work?" "How can one be aware and self-supporting when reading complex texts?"

At the same time that students were reading regularly with their buddies and reflecting on their literacy development process, the eleventh graders were also closely reading novels, and analyzing the writing techniques used so that they could put them to work in their own writing.

READING BUDDIES
THE CHILDREN'S LITERATURE PROJECT
RANDY SCHERER • MELE SATO
RHEA MANGUIL • MARI JONES
MARISSA ADAMS • BRIONY CHOWN
ELEVENTH GRADE • HIGH TECH HIGH MEDIA ARTS

LANGUAGE ARTS LEARNING GOALS:

- To write and publish a high-quality, well-revised and edited original story at the appropriate reading and developmental level for your audience
- To identify elements of quality in classic literature, and use them in original writing (i.e., characterization, plot and theme development, diction, detail)
- To understand the literacy development process of young children

HISTORY LEARNING GOALS:

- To understand the historical contexts of the Great American Novel
- To understand the historical context of specific examples, such as The Great Gatsby

SOCIAL AND EMOTIONAL LEARNING GOALS:

- To be self-aware and work in service of others
- To support each other's development
- To recognize personal strengths in ourselves and others
- To recognize the feelings and perspectives of others

For most of the project, the class followed a regular schedule. On Mondays, Wednesdays, and Fridays, they built their own capacities as readers and writers. They read and analyzed great literature and wrote and critiqued their own stories.

On Tuesdays and Thursdays, they met with their reading buddies. Those days typically began with a brief eleventh grade class meeting that featured goal setting, preparation for literacy work, and gathering of resources. Then the students met with their buddies to do focused one-on-one literacy support.

After reading with their buddies, the class had a debrief. Sometimes Randy led the debrief, with a focus on "What did we learn and what does this mean for our work?" At other times, the elementary teacher led the debrief with a focus on early literacy skill development. Sometimes the class solicited feedback from the elementary reading buddies and used that to drive the debrief.

WRITING PROCESS

Every eleventh grader had at least three literary influences: one recommended by the teacher and two that they selected themselves. Each student identified at least one specific element of quality along with specific examples in their literary influences. Effectively using these elements in their own writing then became their learning goal. For example, a student might say, "I want to use diction in characterization similar to the way F. Scott Fitzgerald does in Chapter 2 of *The Great Gatsby* when we meet Tom."

Students worked in a consistent editing group: four students with a lead editor in each group. The groups were co-designed by the students and teacher. The class developed a common editing practice, which the groups then used consistently to critique their stories. Concurrently, they critiqued and analyzed classic literature with the same method that they used to critique their own stories.

Students had learned about reading levels from the elementary teachers. As they were writing their stories, every student uploaded a sample chapter to a Lexile scoring system online to identify reading level, sentence length, word complexity, and other elements that they had learned about from the elementary teachers and from their own experience with their buddies. They then compared these Lexile elements to the reading levels of their reading buddies and edited and revised so that their work would be appropriately calibrated to each buddy's reading level. The final books ranged from 30-page stories to 160-page novels.

EXHIBITION

The final visit to the elementary school was a celebration where the authors presented their original books to their buddies. A full class set was also given to the elementary classroom library for future students to enjoy.

"By the end, the mural wasn't just about a kid who had died, but an expression of the whole school's culture."

In 2011, on the second to last day of school, ninth grader Sean Fuchs and his younger brother were killed in a horrific murder-suicide. The next day, one of his friends asked Patrick Yurick, their art teacher, if they could create a mural in his honor. Thus began the Imagine Mural, which turned into a year-long project that every student and staff member at the school had a hand in.

Sean had been a part of Patrick's afterschool Comic Book Project. Over the following summer, the Comic Book students met frequently to plan the mural. A fund had been set up to honor Sean and his brother, and their mother contributed funds to help pay for the mural.

The group decided to honor Sean by taking a poem he had written in his English class and using it as inspiration for the mural. Sean was also a musician, and his favorite song was "Imagine" by John Lennon, so that song also inspired the mural's imagery. Since the mural was going to hang in the front of the school, greeting visitors and new students, it had to both represent the school and honor Sean.

Patrick wanted to use the experience of the project to support the grieving process for the whole school. Even though not everyone knew Sean well, it was a violent and traumatic incident for the entire community. Patrick wanted to find a way for every member of the school—students, faculty, and families—to have a chance to contribute to the mural.

Two groups worked on the project in the fall semester: freshmen who were in the class with Sean's former teachers, Ted Cuevas and Kay Flewelling, and Patrick's eleventh grade art students. The design for the mural was split into six panels so each class was responsible for designing three segments.

Students created many drafts of the design. The art students investigated the history of murals and landscape installations, while the humanities students read fiction and non-fiction about future visions of humanity and the planet. The two classes needed to communicate with each other as they worked through drafting and revision. During two staff meetings, students presented their close-to-final drafts of the design to the faculty.

Once all the designs were approved, the mural panels were prepped to be painted and the mural panel designs were stenciled onto blank staging. A day-long community painting experience was planned so that all staff and students had the opportunity to come help paint a section of the mural.

After the community painting experience, the eleventh grade art students worked alongside two local muralists on finishing touches and detail work. The panels were sent to an auto body shop, where they were treated for UV protection. At the same time, one student decided her senior project would be to re-landscape the area around the mural so that it would be easy for people to approach it and sit and contemplate. Sean's mother donated a bench in his honor.

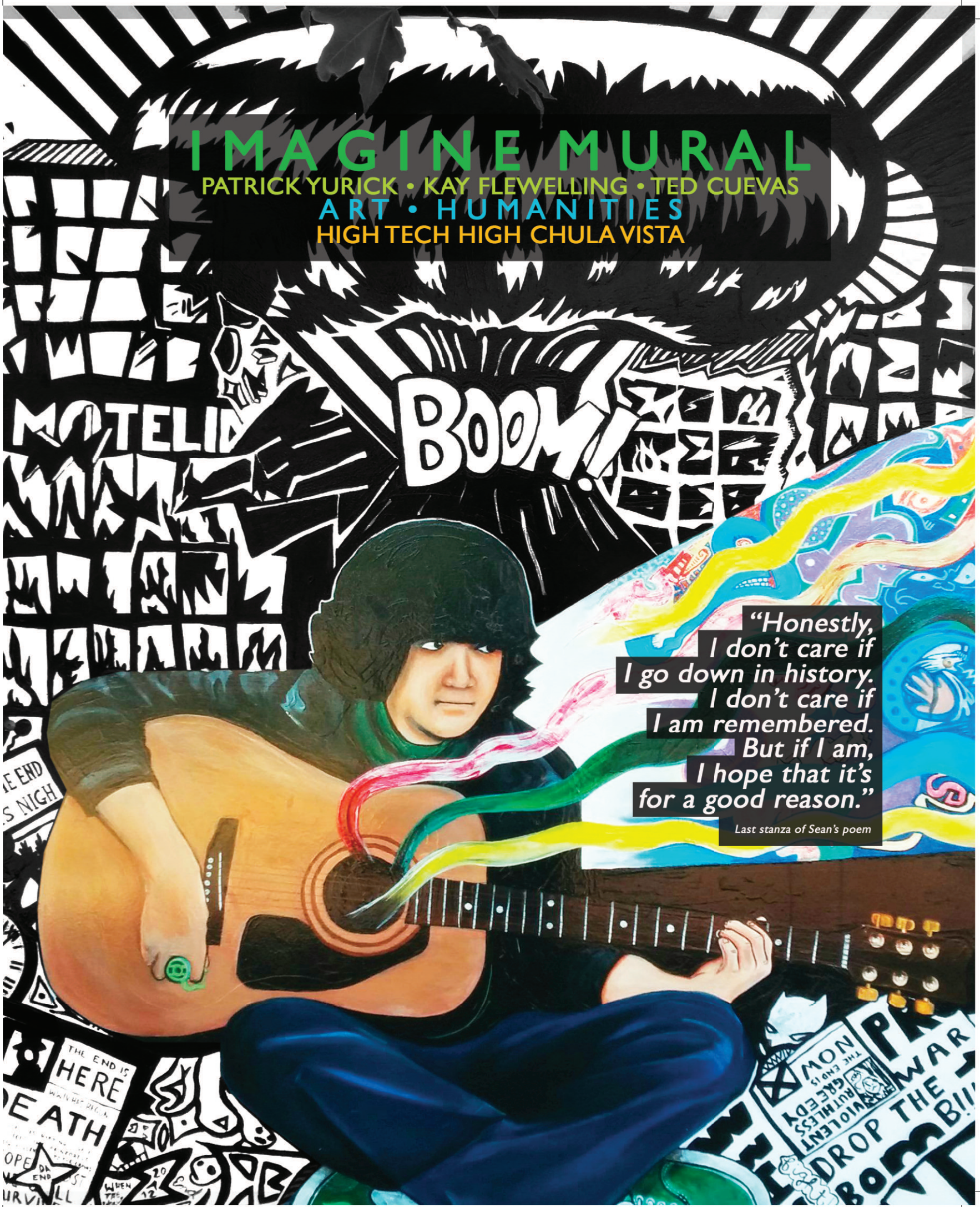
The mural was unveiled at an all-school assembly. Teachers and students spoke about Sean, and a friend of Sean's read the poem that inspired the mural.

IMAGINE MURAL

PATRICK YURICK • KAY FLEWELLING • TED CUEVAS

ART • HUMANITIES

HIGH TECH HIGH CHULA VISTA



"Should I eat that?"

Randy Scherer and Brandon Davidson wanted their students to answer that question with increasing degrees of reflection and sophistication. They wanted to support students in developing healthy philosophies of eating and a critical eye for supposed scientific claims, the law, economics, diets, and more. And, they wanted them to connect with each other and their families.

In this project, students chose a "food philosophy" and kept a journal of all they ate for the eight weeks of their study. They interviewed family members about favorite recipes and their history, tried them out, and wrote a cookbook containing the best of them. They read non-fiction books such as *The Omnivore's Dilemma* and *Fast Food Nation*, as well as many articles about nutrition and food production. This was around the time that New York City banned extra-large size soft drinks, and students conducted a mock trial with written arguments about whether and to what extent the government had the right to regulate what we eat and drink.

In their biology lab, students made yogurt to understand bacterial growth and DNA replication. They grew, harvested, and prepared food with wild yeast, micro greens, and mushrooms, testing their growth under varying conditions. They studied the chemical processes in digestion. They experimented with fermentation to make ginger ale. Over the course of the semester, each group had to make something in the lab that was served to their peers; some of the favorites were sauerkraut, kimchi, and sourdough pizza.

Randy and Brandon launched the project with a surprise cooking challenge. Two large tables in the classroom were covered with black table cloths, which were whipped off to reveal a wide assortment of ingredients. In groups of three, students could choose from one of three recipes (fish tacos, watermelon salsa, or hummus), and raced to gather their ingredients and begin cooking. Each group prepared their dish, served it to their classmates, and got their reviews.

LEARNING GOALS

- To research and write a compelling historical narrative
- To craft an evidence-based argument
- To research, write, and edit nonfiction articles, recipes, and directions
- To learn micro and macro photography skills
- To understand broadly the science of nutrition
- To understand the history of food production, nutrition, and eating habits in the U.S.
- To understand the chemical processes involved in digestion and metabolizing nutrients
- To understand the chemical processes in fermentation, carbonation, bacterial growth, and fungal growth

The Whole Meal consisted of a series of mini-projects or deliverables, interspersed with lab experiments, discussion of readings, and visits to and from experts in farming, cooking, and nutrition. Each student spent the first week trying out different "philosophies of food" (i.e., veganism, locavorism, the paleo diet, their cultural ancestral diets). By the beginning of the second week, every student committed to a specific philosophy and followed it for the next seven weeks—this was what guided their food journals.

One deliverable was a historical narrative that told the story of three specific meals that were significant across three generations of each student's family history.

Students wrote narrative accounts of meals, such as the final meal their mother ate before immigrating to the U.S., or the dinner served at their grandparents' wedding. Each student presented the three narratives to their family in a handbound book at the exhibition.

A second mini-project was a mock trial focused on whether the government has a right to regulate what its citizens eat. The trial included lawyers and their staff who had to conduct research; witnesses who played the role of real or imagined characters, such as Michael Bloomberg, Milton Friedman, a sugar lobbyist, or an organic farmer; and justices who each had to write an opinion, as well as a joint opinion.

The final product was a cookbook that included essays, art, and photography, as well as recipes. With the advent of internet recipes, students realized that successful cookbooks had to include much more than recipes. They studied models of successful cookbooks, and noted their stories, photos, and art. Each chapter was organized around one of the chosen food philosophies. Students picked their own topics to write essays about, such as "The History of the Carribean Diet," "It was the Celiac Disease," and "Why Paleo?"

EXHIBITION

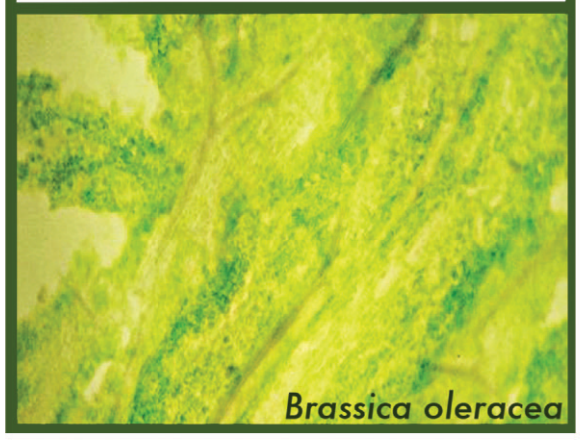
The final exhibition was a pop-up restaurant, to which family, friends, and visiting experts were invited. Each group had their own restaurant section and prepared favorite dishes from the type of food they had studied. Original art and food photography hung on the restaurant walls, and the project's process was displayed as well.

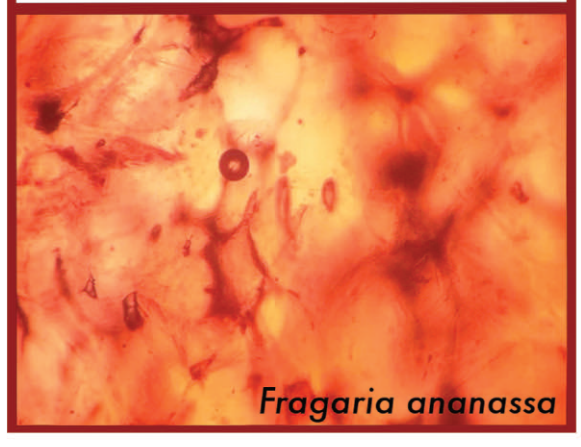
THE WHOLE MEAL

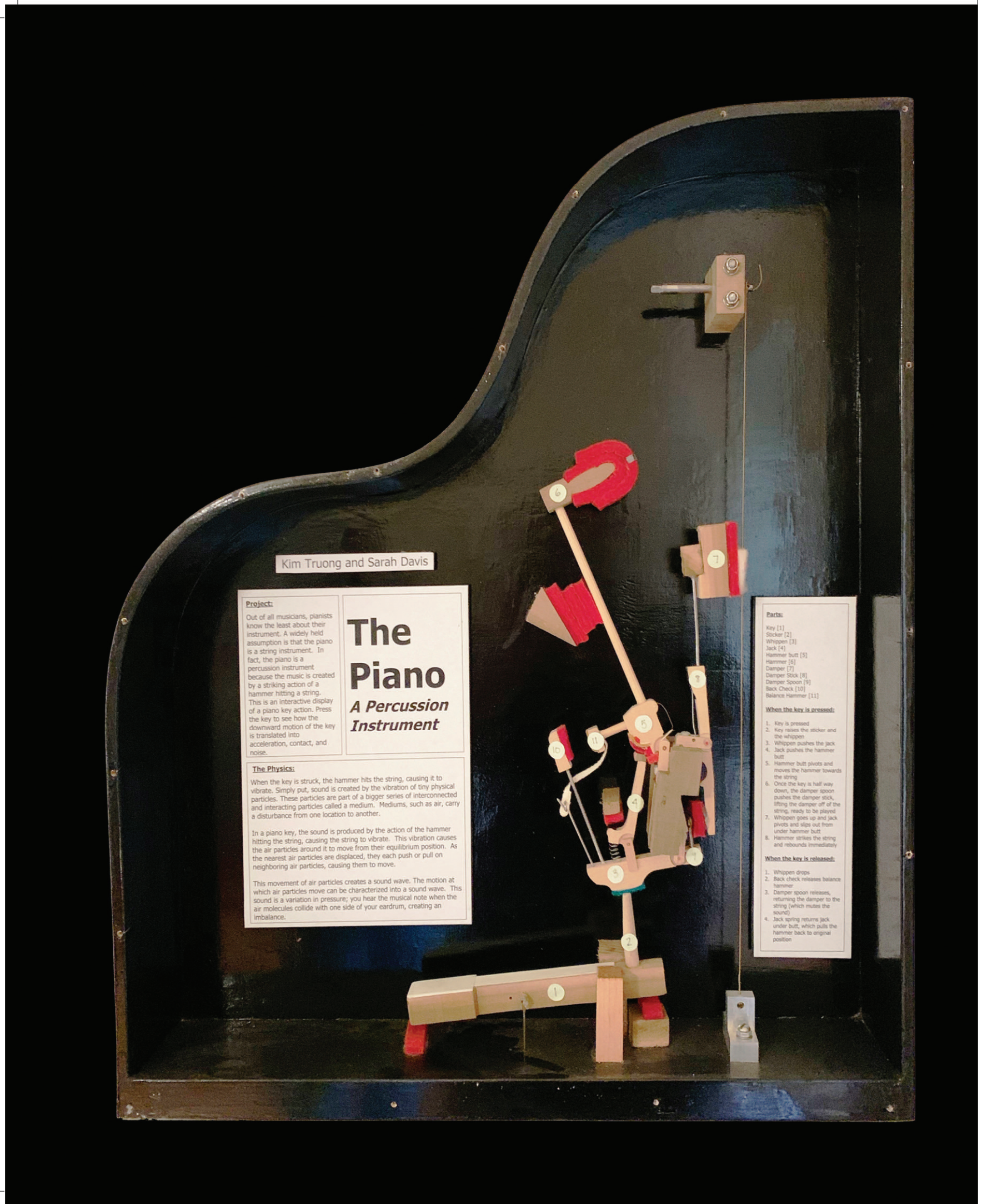
BRANDON DAVIDSON • RANDY SCHERER

HIGH TECH HIGH MEDIA ARTS

ELEVENTH GRADE • HUMANITIES • BIOLOGY






Kim Truong and Sarah Davis
Project:
Out of all musicians, pianists know the least about their instrument. A widely held assumption is that the piano is a string instrument. In fact, the piano is a percussion instrument because the music is created by a striking action of a hammer hitting a string. This is an interactive display of a piano key action. Press the key to see how the downward motion of the key is translated into acceleration, contact, and noise.
The Piano
A Percussion Instrument
The Physics:
When the key is struck, the hammer hits the string, causing it to vibrate. Simply put, sound is created by the vibration of tiny physical particles. These particles are part of a bigger series of interconnected and interacting particles called a medium. Mediums, such as air, carry a disturbance from one location to another.
In a piano key, the sound is produced by the action of the hammer hitting the string, causing the string to vibrate. This vibration causes the air particles around it to move from their equilibrium position. As the nearest air particles are displaced, they each push or pull on neighboring air particles, causing them to move.
This movement of air particles creates a sound wave. The motion at which air particles move can be characterized into a sound wave. This sound is a variation in pressure; you hear the musical note when the air molecules collide with one side of your eardrum, creating an imbalance.
Parts:
Key [1]
Sticker [2]
Whippen [3]
Jack [4]
Hammer butt [5]
Hammer [6]
Damper [7]
Damper Stick [8]
Damper Spoon [9]
Back Check [10]
Balance Hammer [11]
When the key is pressed:
1. Key is pressed
2. Key raises the sticker and the whippen
3. Whippen pushes the jack
4. Jack pushes the hammer butt
5. Hammer butt pivots and moves the hammer towards the string
6. Once the key is half way down, the damper spoon pushes the damper stick, lifting the damper off of the string, ready to be played
7. Whippen goes up and jack pivots and slips out from under hammer butt
8. Hammer strikes the string and rebounds immediately
When the key is released:
1. Whippen drops
2. Back check releases balance hammer
3. Damper spoon releases, returning the damper to the string (which mutes the sound)
4. Jack spring returns jack under butt, which pulls the hammer back to original position

ACKNOWLEDGEMENTS

High Tech High teachers are required to do significantly more than traditional teachers. They develop their curriculum that enables students to see what it is like to be writers, historians, mathematicians, scientists, and artists through subject-integrated projects. The teacher designs and tailors these projects with the input of students in order to meet their learning goals.

The teachers are then asked to document what they have done with the students and what the students have done during their time together. As an art teacher, documentation was more straightforward for me; I imagine the struggle to create tangible artifacts of student work is a whole other full-time job for teachers of other subjects. The teachers that we hit up to participate in this collection care about their craft, their students, and about documenting their work to help other teachers.

These teachers made the extra effort to put their work out there, took criticism, and improved. They modeled what they want for their students: creative analysis, and a constant striving to improve one's craft.

Thank you for your work and participation, this is your reward.

Jeff Robin

Thank you to all the teachers and students who shared their work with us. I especially appreciate the time that teachers take to document their work. Without that extra commitment on top of everything else teachers do, this book would not have been possible. We wrote this book in the year of remote schooling during the 2020 COVID pandemic. Interviewing teachers and seeing images of students collaborating to create beautiful projects kept me hopeful that we could one day return to a world of in-person, creative, and engaged learning.

The WISE (World Innovation Summit for Education) prize, awarded to Larry Rosenstock in 2019, made this project possible. Thank you to Her Highness Sheikha Moza bint Nasser for creating a prize that recognizes and elevates the work of educators around the world. Thanks also to Stavros Yiannouka, Audrey Giacomini, Ameena Hussain, and all the WISE and Qatar Foundation staff for their support and commitment to project-based learning and to engaging education for all students.

Closer to home, I also want to thank Randy Scherer, Alec Patton, Patrick Yurick, Brent Spirnak, Nikki Hinostro, Melissa Daniels, Robert Guerra, Luke Piedad, Jimena De La Torre, Briony Chown, and Rob Riordan for their support of the project. Thanks to Lauri Scherer for astute editing. Collaborating with Jeff Robin kept me laughing during a very dark year. Finally, thank you to Larry Rosenstock for his steadfast love and support for students, teachers, this project, and me.

Jean Kluver