This study is a component of the HTH San Diego Bay Study, now in its eighth year. Aware of our previous publications and DNA barcoding research, biologists from the Southwest Division of the U.S. Navy asked us to do a pilot study for a large-scale ecological survey of the bay. The project focused on the influx of non-native species that has created a shift in the regional ecology, resulting in a number of current and potential ecological and economic problems.

We began with a focus on benthic marine invertebrates. Student teams took on taxonomic groups, striving to identify all species within their taxa (e.g., Molluscs, Arthropods, Cnidaria). They collected samples from the bay for DNA barcoding in the HTH biotech lab, identifying a variety of organisms and invasive species. Their findings will be shared with the Invasive Species Management Plan.

Through such surveys students and collaborating scientists could prevent and slow the spread of invasive species through early detection, rapid response, and eradication, ultimately reducing the effects of bioinvasions on human health, the economy, and the oceans.

**Student Reflection**

We learned biotechnology skills and gained an understanding of how these applications could serve the community. We generated over 100 DNA barcodes and discovered eight non-native and invasive species. We presented these results to the annual meeting of the Southern California Society of Environmental Toxicology and Chemistry, where we showcased the phyla we had discovered and the threat that invasive species pose to the region.

—Kathleen Estrella, 12th grade

**Acknowledgements**

The project exemplifies community-based conservation and Jane Goodall’s Roots & Shoots program. It was supported by the U.S. Navy Southwest, Life Technologies, the Regional Occupational Program, and the Port of San Diego. DNA sequencing was conducted by the Aquatic Ecology Division of USGS. Thanks to our partners!

Visit Jay Vavra’s portfolio at [http://hthbiotech.sdccte.org](http://hthbiotech.sdccte.org)
In 1961 the Soviet Union constructed a wall in Berlin that symbolized the cold war divisions that brought the world the closest it has ever been to annihilation. We asked our students to create their own wall, focusing on the conflicts of the 20th and 21st century and a specific human body system. Each panel of this Wall of Resistance offers student perspectives regarding the effects of the war on society, the human body, or even the individual human cell.

**Teachers’ Reflection**
It was rewarding to see the students engaged in their research and the astounding creativity that emerged in their art. The essential questions driving each art piece were generated by the students, allowing for a diverse set of reflections on particular times and body systems. No two pieces were alike; each conveyed a different message and tone. In the end the students created characters related to their art pieces and portrayed these characters on the night of exhibition. The room was vibrant not just from the images and colors on the walls, but from the students acting and engaging the public on their thoughts of war.

**Student Reflection**
Until I actually did the research, I had no idea how much impact war has on people and society. Not only does it affect the soldiers fighting in the war, but their families and friends as well. I studied the circulatory system, which pumps and circulates blood throughout the body. When a soldier, for example, is shot it can create something called cavitation, where the bullet creates a cavity in the skin and can potentially leave room for infection from bacteria. Soldiers and civilians are being shot right now in the war in Iraq, and it is mind-boggling that this is the norm over there, yet the sound of a word such as “cavitation” brings chills to my body. This project re-affirmed my beliefs about war and how unnecessary and ineffective it is.

—Maddie DeVault, 11th grade

To learn more about this project and others visit [www.hightechhigh.org](http://www.hightechhigh.org) and Jenny Morris and John Bosselman’s digital portfolios at [http://dp.hightechhigh.org/~jmorris](http://dp.hightechhigh.org/~jmorris) and [http://dp.hightechhigh.org/~jbosselman](http://dp.hightechhigh.org/~jbosselman)
While much of the Western academic tradition focuses upon the external world, we shifted the paradigm and became “inner astronauts” in order to understand how our perceptual lenses influence that which we study. Integrating concepts from psychology, mythology, sociology and Eastern spirituality, we created masks as tangible representations of our lives, hopes and dreams.

—Students Michael Lung, Carter Muenchau, Emlyn Thompson

**Student Artist Statement Excerpts**

My idea was to show my life at school, and how I put on a white mask, but also that I’m breaking through it. This psychological repression will not last. Under the mask is myself which is black. It represents black stereotypical things I like to do, but can’t talk about at school. In creating this mask I realized I don’t want to hide myself. It’s a rude awakening.

—Iran Daresbourg

Women have been socially constructed to think being emotional is a bad thing. Living in this society, I too hide my true emotions. My mask portrays a person who has used smiles to cover up frowns, laughter to cover up tears, and jokes to cover up harsh words.

—Jewel Powe

My mask is made of plaster strips, four layers of Plaster of Paris, and two coats of Modge Podge. I am truly sensitive. Society ostracizes men who show the slightest bit of emotion, and so, over the years I have developed a hardened shell.

—Chris Connell

**Teacher Reflection**

Every action begins with a thought, and every thought rides upon a sensation. What if young people learned how to release negative thought patterns before they devolved into destructive behavior? The process begins with an honest acknowledgment of their inner landscape.

To learn more about this and other projects visit [www.hightechhigh.org](http://www.hightechhigh.org)
This project looks at how and why seafaring peoples ventured out to the deep blue, whether for trade, adventure, or conquest. Students look at how environments and situations influenced technological advances, navigation methods and more. To experience firsthand the difficulties facing ancient seafarers, the students spend days learning to sail and paddle an outrigger canoe. They examine the technology and physics of sailing while building their own sail cars that can move upwind. They consider how different societies solved problems common to water travel: stability, buoyancy, movement, and direction.

Project deliverables included the sail car, scale maps requiring trigonometry, and demonstrations explaining buoyancy, balance, and propulsion. Students exhibited these at our spring exhibition, where they also performed original plays.

Teacher Reflection
Students create their maps on separate quadrants of wood, which are then assembled. No one is allowed to touch another student's piece of the map. This rule sets a high standard, since individual mistakes in the math, plotting, or painting become obvious when the boards are assembled. Students help each other to do the work correctly, because all four pieces are necessary to exhibit their maps.

Student Reflection
Many components came together in a visual presentation of the journeys of ancient seafarers. Everyone learned the fundamentals of cartography, the importance of meticulous calculation, and trigonometric functions behind every scaled map. We had to work efficiently in teams with people we had never talked to before, creating a professional piece for display. Making a map from scratch was a magnificent way to learn about real world math connections and the seafarers that traveled the ancient world.

—Christiane Pham, 9th grade

To learn more about this project and others visit www.hightechhigh.org and Juli Ruff’s digital portfolio at http://dp.hightechhigh.org/~jruff
When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand and the execution is a perfunctory affair. The idea becomes a machine that makes the art.

—Sol LeWitt, conceptual artist

Each student designed a unique art piece using a set of mathematical concepts. Students then followed their own directions to create their piece on a canvas. The class then chose 11 of these pieces to enlarge on the wall, demonstrating that in conceptual art, the original artist need not be the one to execute the piece. By following their classmates’ instructions and images, the students were able to realize perfectly their classmates’ concepts.

Teacher Reflection
I had three main goals for my students: to strengthen their ability to explain their mathematical thinking, to practice math concepts they had learned so far, and to gain exposure to a new art form. While creating a design was somewhat challenging, students struggled most with composing clear directions for their designs. It took many drafts to make directions that were clear, concise and correct. This was a great exercise in proof: how could they know that their directions would produce exactly their design if followed by someone else? It was a nice surprise just how rigorous this component of the project became.

Student Reflection
My partner and I created a piece called “Tree of Lines,” using simple lines and angles to create a tree. The concept was simple, but if someone else were to re-create our piece it might be harder than it looks. I learned that math can be explained through many different forms and concepts. Through art it was more exciting, yet still challenging. Having someone else re-create our art on a wall instead of seeing it on a small canvas definitely made us very proud of our work.

—Yleana Cueva, 11th grade

To learn more, visit www.hightechhigh.org and Amy Callahan’s digital portfolio at https://sites.google.com/a/hightechhigh.org/amycallahan/
Economics Illustrated
Dan Wise, Humanities, High Tech High
Jeff Robin, Art, High Tech High

Tenth grade students in Humanities and Digital Imaging created a book on economic concepts and their applications. Each student created two pages: the first defining an economic term and providing examples of it, and the second applying the term to a current event in an original article. For each page, the student created a linoleum block print to illustrate the content.

Teacher Reflection
I wanted my students to see the world through the lens of economics. We began with whole-class instruction and shared readings before breaking into literature circles and, eventually, individual research topics. I was pleased with the variety of content that students chose to address: international issues like donations to Haiti and AIDS in Uganda, national concerns like foreclosures and unemployment, and local ones like disputes over local beaches and fear of shark attacks.

—Dan Wise

Student Reflection
Economics is called the Dismal Science, but with Economics Illustrated it was anything but. In this project we balanced writing, social science and art. Beforehand we may have had a basic understanding of economics, but nothing really beyond the clichés of the stock market. We learned about dozens of economic principles, ranging from everyday inflation to more cutting-edge regression analyses. We tried to get each article just perfect; my article on the Theory of Comparative Advantage is probably my most heavily edited piece to date. Some people had difficulties with the linoleum block carving, both in what to carve and how to carve it. In the end, though, we managed to create a stunning book that we can be proud of.

—Kai Wells

To learn more, visit www.hightechhigh.org and the authors’ digital portfolios at danwise.googlepages.com and jeffrobin.com

To buy the book visit www.blurb.com and search for Economics Illustrated.

To see coverage of the project on The New York Time’s Freakonomics Blog, visit: http://freakonomics.blogs.nytimes.com/2010/06/24/economics-for-and-by-10th-graders/