Fostering Student Innovation

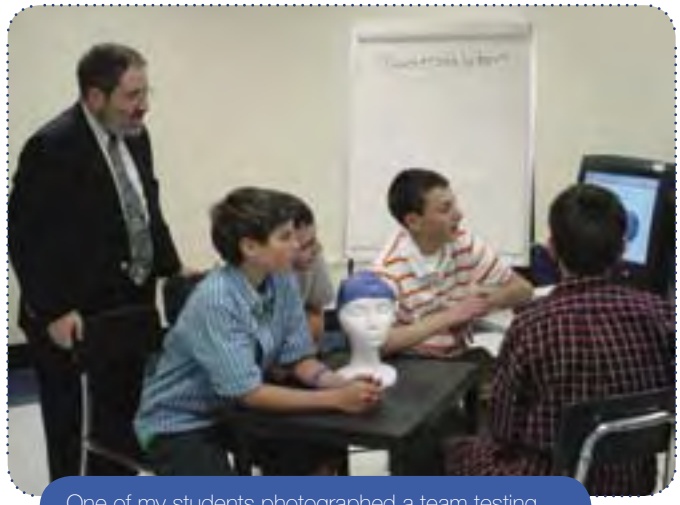
A competition motivates students to assess technology's role in society and to study science and tech further.

Computer Science & ICT

Students need to be able to develop an appreciation of how technology has changed our lives, become more aware of current developments in technology, and be able to form a personal vision of how technology could be used to improve the world in the future, so they can become successful leaders for the future.

The Toshiba ExploraVision Science and Technology competition (http://www.exploravision.com) is actually a terrific curriculum framework that can be used to encourage students to learn more about new technology and help them develop a personal vision of how technology can be used to benefit society in the future.

I have found that the most difficult issues in getting started with ExploraVision in my eighth grade technology classroom have to do with forming research teams, coming up with a workable idea, and refining that idea. To make optimal use of the framework as part of a classroom study unit on Designing Technology for the Future, I use several strategies when teaching my unit.



One of my students photographed a team testing its neurotranslator Web site as I looked on. Read about the neurotranslator in 2005 Edgemont Award Winners on p. 31.

Incorporate Current Events

During the summer and throughout the year, I scan news headlines and Web sites for stories about how an invention or technology proposes to make life better. I keep electronic logs and paper files on what inventions might be of interest to students. I also ask students to collect articles.

Help Students Organize Project Teams

Because this is a long-term project, students need to learn how to work together, maintain high levels of energy, and divide the workload so everyone has a job and takes responsibility for part of the project. Generally speaking, I let students informally gather in class for one or two periods to bounce around random ideas, so they can select their own teams of three or four students. In classes where I suspect this may be difficult, or where there may be obvious personal conflicts, I use a sociogram-like method so I can choose the teams with student input.

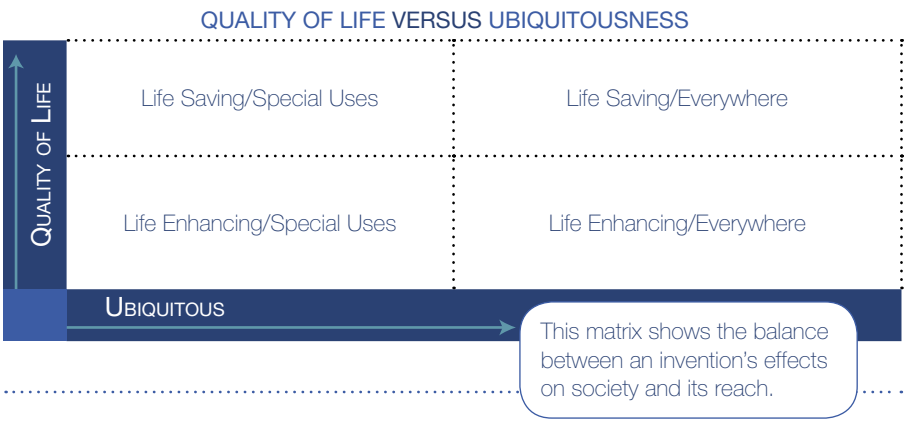
Students write their name and the names of four other students they would like to work with, as well as one student they would prefer not to work with on index cards. After mapping the index card information to a grid, I try to group students with their best choices in teams of three or four.

Once the team members have been identified, I have them select roles such as:

- Team leader (resolves team conflicts, sets schedule, plans team meetings, provides status updates to the teacher on team progress)
- Documentation specialist (keeps track of all electronic files and paperwork produced by the team)
- Bibliography and Internet link keeper (documents and tracks all research sources used by the team)
- Lead researcher (either does most of the research or directs it)
- Lead writer (does most of the writing for the project)
- Editor
- Encourager (motivates team by making uplifting comments)

In most teams, members assume dual roles, providing for overlap, support, and redundancy in case students are absent from class. I discuss the need to ensure that roles do not conflict (e.g., the student who writes a section of the paper should not also edit that section) but also that tasks get completed in the relatively short timeframe we must prepare our contest entries. Each team member is then prepared to jump in and perform tasks not in his or her "job description" when another team member is absent.

By Norman Silverman



I then use a variety of team building activities to get them started. Some suggestions include designing a team logo, brainstorming a team slogan, and compiling photos of the team for a team information sheet.

Help Students Select an Idea

One of the most difficult things to do is to brainstorm an innovative technological invention or process that will benefit society. Students need to identify an important societal problem and then identify technologies and design an invention that could be used to solve that problem.

To help students frame what is an important problem to solve, I have designed a graphic organizer called the Quality of Life versus Ubiquitousness matrix.

One suggestion to students is to think of problems that can be solved by inventions that are life saving and will eventually be used by a wide audience. Another choice is to seek a market niche that has not been exploited by developing an invention for an important, focused audience. In either case, this matrix helps students begin to think about the difference between life-saving and life-enhancing inventions and reaching a wide or specialized audience. It helps them refine their problem definition and better focus on who the invention is serving. The best ideas for problems to solve come from students who have had a problem that has personally affected their own lives or the lives of their friends and family.

Present Many Inventions and Themes

A review and class discussion of a number of new technologies and inventions is essential to help prime some students' imaginations to help them select appropriate technologies to solve the problem. I look for inventions and technologies students can relate to and ask them to imagine how these technologies or inventions could be used in the next five years. We spend several class periods discussing and researching inventions or technologies of interest.

The cell phone is a convenient example students can relate to that incorporates many technologies from computer chips to LCD displays to the transmission of electromagnetic waves. Students enjoy discussing how cell phones have evolved from basic wireless conversation devices to text messaging tools, sophisticated location tracking computers, portable video games, and cameras. I then ask them to imagine what is next.

You can review the titles of prior projects designed by students at the ExploraVision Web site to give you a flavor for what technologies students consider hot and interesting. Inventions and topics that we have touched on in class in the past have included radio frequency identification tags, optical light emitting diode (OLED) displays, GPS, nanotechnology, and biofeedback using brain-to-computer interfaces or biosensors.

Teach Students Ways To Refine And Improve Their Project Invention

SCAMPER (Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse) is just one methodology to help students find ways to reexamine their inventions and improve their designs. You can find a lot of information on this on the Web, and Intel has a number of complete units and activities to get you going in their free online curriculum called Design and Discovery at http://www.intel.com/education/design/.

Research, Research, Research

Students cannot rely on just a few sources or media to support their designs. I suggest that they begin their research by reviewing articles in newspapers, magazines, or industry trade publications. Many of these are online or in the library. I encourage them to find multiple sources for the same invention or technology. If they need even more details on how a specific technology works, they can do more research on the Web or use subscription databases our school has access to such as EBSCO, PROQUEST, or Student Resource Center. When doing research on the Web, I encourage students to cross-check their information with other Web sites and resources in an attempt to be sure it is accurate or reliable.

When possible, I encourage them to contact the original authors of research by e-mail or to use an ask-an-expert Web site to find experts on their technology. Our school community is privileged to have a variety of parents and friends in various science and technology businesses, so I have also suggested that students consider interviews with members of the community who are experts in the field

related to their invention. ExploraVision encourages the use of mentors, who can act as direct resources of information to the team. If you have open school night early enough in the year, you may want to remind parents that they are welcome to nominate friends who may want to be mentors for this project.

Give Time to Write and Edit the Paper

My students who are successful go through at least four or more full edits of all the sections of the project before they are ready to submit their research paper. The various sections of the paper have specific guidelines and requirements. Using a backwards design approach, I suggest to most teams that they decide on an important problem to solve and then begin to write a summary and concluding sections of the paper first. I encourage them to write in their own words and quote directly from their sources only when absolutely necessary. I strongly suggest that they draw on personal experiences and interests to make their paper real and engaging as much as possible.

Check the Feasibility of the Project

Throughout the process, I have students consider some obvious but important questions about their idea and research paper:

- Has this invention been created already, or is it near release in the next year?
- Have students done enough research to convince themselves (and me) that it is probably an original idea?
- Do students have enough supporting research and written details to support their technical design?
- Does their invention solve a trivial problem?
- Does their invention use a creative approach to solving the important problem and incorporate interesting technologies? Have they stretched their imaginations?
- Is it likely that this could, or should, be built 20 years in the future?

Selected 2005 Edgemont Award Winners

2005 Regional Award Winner

NeuroTranslator. The team's invention proposes to help comatose patients communicate with doctors and family by converting electric signals in the brain into auditory and visual information that can be read and interpreted by a medical expert. Brain waves are detected through a cap worn by the patient and are analyzed using a sophisticated computer and interface. The thoughts are converted to pictures, words, and a synthesized voice, using advanced pattern recognition software. This project is based on groundbreaking work at the Wadsworth Institute in New York and elsewhere.

2005 Honorable Mentions

Nano Skis. Nanotubes and a sophisticated array of sensors on the bottom of these high tech skis help ski enthusiasts do a better and safer job of navigating difficult terrain. The skis automatically adjust their speed to different snow conditions as well as their weight and motion.

Eat Right Buddy. The Eat Right Buddy is a lightweight armband that plans to help America address the growing problem of obesity in our society. The Eat Right Buddy scans all the food that is eaten by its owner and provides feedback to tell the owner if they made a healthy choice. Biosensors that test for different chemicals in the owner's blood stream are integrated with a voice recognition system, a food pattern matching database, a computer/memory chip, and an OLED screen to give the user advice as to what to eat, and to also track changes in metabolism.

Highlight My Students' Successes

My students have been extremely successful with ExploraVision. In 2003, my teams were awarded 3 honorable mentions. In 2004, they received 5. And in 2005, Edgemont students received 1 regional award and 7 of the 49 honorable mentions in New York.

I have noticed that many students who were not interested in studying science and technology have a greater appreciation of technology's role in society. Many students who would not have considered participating in an honors science class or entering another tech competition as they enter high school have changed their minds, and said they will consider taking some form of advanced science in high school. Many students have approached me and asked if they could do an after-school tech competition or program with me next year.

The wins in ExploraVision have validated for me the importance of having the flexibility in my class to be able to set aside large blocks of time to allow students the time to contemplate an original and personal technological vision of the future they can take pride in. Kids talk about their inventions during their work, and even after the project is completed, as if their inven-

tions were realities that could show up in our homes or offices tomorrow. Perhaps this will encourage some students to become inventors or technology leaders.

Recognition of my students' inventions gives them the courage to believe that they have the power to influence the future for the good of the world. More immediately, I believe that students who succeed and receive recognition from their work in ExploraVision go on to high school with more enthusiasm for their studies. Working in a team on this type of project also helps them to grow personally. They gain the confidence to work with others, think outside the box, and experience how to consider solutions to problems yet to be discovered. The recognition encourages them to keep thinking creatively, and to perhaps consider a leadership role in whatever they do. The recognition also encourages other students, giving them hope that they can succeed, too—that effort and creative thinking can pay off.

Standards: *NETS•S* 2, 6; *NETS•T* II (http://www.iste.org/nets/). *NSES* Content Standards Grades 9–12 E, F (http://www.nap.edu/readingroom/books/nses/html/).

Norman Silverman is the technology teacher for the Edgemont Jr./Sr. High School in Westchester County, New York. He has permanent New York State certification to teach technology education and business education. He holds a bachelor's degree in computer science and master's degrees in business administration in marketing and in education from New York University.