



From Rags to (Educational) Riches

By Katie Neith

Standing in front of a seventh-grade science class, Dave Zobel (BS '84) poses a seemingly easy question. “What is light?” he asks the kids, who are assembled at round tables covered with strips of Mylar, pieces of plastic, a cardboard box, and various other materials. Half of the class raises their hands. The answer, however, is not so simple. Each kid has a different reply.

“Light is magical,” answers one student.

“Light is all colors,” says another.

Zobel explains that while *light* is a familiar word, it is not easy to define. And so begins a lesson on reflection, refraction, and magnification that is designed to foster curiosity. After all, science is really about having lots of questions, but not necessarily all the answers, he tells the students.

But Zobel is not a science teacher. In fact, he's not a teacher at all. He's a freelance science writer helping test an innovative program called [Trash for Teaching](#) (T4T). And the scraps on the table are just that—manufacturers' remnants that otherwise would have ended up in a landfill.

Instead, the “trash” is prompting discussions: The students examine the brightly reflecting strips of Mylar, trying to figure out why their images appear inverted. Next, they hold up Petri dishes to different sources of light and talk about the colors they see reflected. Magnification is explored through the use of eyeglass lenses, and the cardboard box is used to explain the concept of a pinhole camera.

T4T collects clean and safe industrial castoffs and repurposes them for science and arts education, delivering materials to schools and offering teacher workshops on classroom instruction. Over 25,000 kids in the Los Angeles area have used T4T “trash” as part of a school project.

The nonprofit organization is the brainchild of Kathy and Steve Stanton, who run a local company that manufactures specialty packaging supplies. In 2004, their son—then three years old—began attending a Reggio Emilia preschool. Developed in Italy in the aftermath of World War II, the school's method encourages learning by having young children explore “found” items in an unstructured way. The Stantons realized that their business created a lot of materials through its waste stream, so they started taking their unsalable by-products and overruns to the school for use in class projects. The multicolored ribbons, die-cut cardboard hearts, long cardboard tubes, and other items were hugely popular with the children, who found many ways to use them; energized by this enthusiastic response, the Stantons developed a pilot program and T4T was born.

“We saw T4T as a logical, simple, and environmentally friendly solution to the need for materials in education,” says Kathy Stanton.

For the past seven years, T4T's Treasure Truck—filled to the brim with colorful materials and fueled by used vegetable oil—has visited L.A.-

Students in Armen Antonian's seventh-grade science class at Sierra Madre School—part of the Pasadena Unified School District—get their first introduction to the Trash for Teaching unit on pinhole cameras. Nick Whiting holds the cardboard tea box that will become the camera's body, while Brian Yik looks on.



area schools for a nominal fee, giving students full run of the truck so that they can cram shopping bags full of whatever gems the truck holds that day, and then create personal masterpieces. The organization is headquartered in a funky warehouse in Boyle Heights that is decorated with art installations built from donated “trash.” Bright blue bins are filled with discards collected from area businesses that donate everything from mass-produced scraps, like the tail end of fabric and foam rolls, to items that have already served their purpose in the manufacturing world, such as plastic tubes and cones used to spool ribbon.

Says Kathy Stanton, “Our ultimate goal is to help teachers, manufacturers, and environmentalists help one another by developing sustainable-reuse systems that encourage our kids to think critically and fuel their imaginations in all subjects by exposing them to non-traditional objects.”

A mutual artist friend introduced the Stantons to Zobel in 2009, and their conversations soon turned to whether this approach might be applicable to science lessons. “For more than a year

I poked around T4T’s bins of parts aimlessly,” admits Zobel. “After all, how do you teach science in this century without rare-earth magnets and oil-immersion microscopes?”

But in late 2010, Intel officials offered to have their sales force assemble science kits as a community service project at their annual convention in Anaheim. They also generously provided funding to cover the collection, storage, and distribution of everything that would go into those kits.

“With a hard deadline looming, I was finally motivated to stop mulling and start designing,” says Zobel. Within a few weeks, he and Steve Stanton had worked out the concepts and drawn up the parts lists for four kits, and Zobel plunged into writing the teachers’ guides.

Zobel admits that putting the kits together wasn’t easy, especially since education is not his field. But fellow alumnus Paul Graven (BS ’85) put him in touch with Professor of Physics Jerry Pine, the director of Caltech’s Precollege Science Initiative (CAPSI). Launched in 1999, CAPSI has been

studying hands-on methods for teaching science in grades K–12. Pine referred Zobel to Jennifer Yuré, a retired science adviser for the Pasadena Unified School District who gave him advice and helped drum up interest among local teachers.

“I have been working with Caltech scientists for many years now, and they always bring a different perspective to the table,” says Yuré. “It’s nice for educators to question each other and think about ways to engage students in science and thinking.”

In addition to hooking him up with the right people, Graven—along with a group of other friends—scoured the warehouse with Zobel, throwing out ideas along the way for fun projects.

“We had a lot of fun going through the warehouse and trying to think about different experiments we could do with the supplies,” says Graven. A longtime friend of Zobel’s, he became involved in T4T because it resonated with his desire to support science education by leveraging the resources Caltech has to offer.

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“Paul stacked a couple of pieces of corrugated plastic on each other and said, ‘Hey, nice moiré pattern.’” The warehouse also yielded such strange and wonderful things as surplus conical bobbins, specimen cups, and velvet discs, which have been incorporated into a lesson plan for building a tin-can telephone.



From left to right: Ryan Garcia checks out his reflection in a piece of Mylar.

Trash for Teaching founder Kathy Stanton examines the magnification properties of an eyeglass lens with Brock Vance.

Sarah Shaklan learns about reflection and refraction while playing around with a piece of Mylar.

was the genesis of the kit on moiré patterns,” explains Zobel. The warehouse also yielded such strange and wonderful things as surplus conical bobbins, specimen cups, and velvet discs, which have been incorporated into a lesson plan for building a tin-can telephone—minus the can—which teaches the principles of engineering. By gathering rubber bands, cosmetic bottles, Styrofoam blocks, and plastic clips, among other items, they formulated a kit that explores the processes of inductive and deductive reasoning.

Zobel says the kits offer surprisingly extensive possibilities, and that teachers can easily adapt the lesson plans to cover as many or as few class periods as desired.

“Kids love to look at our stuff and try to figure out where it came from and why it was thrown out,” says Zobel. “Isn’t it wonderful that we can make something that teaches fundamental things that kids need to learn, but still has a ‘cool’ factor?”

Zobel isn’t alone in thinking that the kits could make an impact on education.

“The kits are a nice ‘extra,’” says Yuré. “They aren’t a full curriculum, nor are they intended to be one, but they’re a useful extension of regular classroom lessons.”

“Using these kits requires more thought and exploration, reinforcing creative problem solving and out-of-the-box thinking,” says Kathy Stanton. “Plus, the underlying message is always environmental.”

According to Zobel, the kits are gaining traction—a success he credits to a growing list of volunteers who have become attached to the program. For example, Rebecca Constantino

of Access Books—a not-for-profit that donates books to school libraries—heard about this project through Zobel and put him in touch with teachers and administrators from Santa Monica, Compton, and Orange County, all of whom are interested in signing up.

In addition, applied physicist Robert Chave, who used to work at Caltech and JPL, stopped by the T4T warehouse after hearing about the organization from a friend, and has since become an invaluable contributor to some of the lesson plans. And a conversation with Alycen Chan of the Caltech Y resulted in T4T being selected as a project for this year’s Make A Difference (MAD) Day, an annual event held every April.

According to freshman Ted Xiao, who spearheaded the event, MAD Day is a time for the Caltech community to put down their research projects and spread out into the community to help others.

“I am an advocate for the health of our environment. Reusing our waste to help young students learn science is something I feel very strongly about,” says Xiao. “After I heard about the mission of Trash for Teaching, I picked it as my MAD Day site immediately.”

Looking forward, Zobel says he would love to design more kits. Even better, he’d like to train others to design kits, too. More kits equal more opportunities for children to learn science in innovative ways. “Ultimately, we’d love to reach as many kids as we can,” he says.

T4T plans to hold a professional-development day, when teachers and administrators could visit the warehouse and learn how to use the lesson plans. Zobel and the Stantons are also working on audiovisual materials to complement the kits.

“The arts and the sciences are some of the first victims when budget

cuts happen. T4T has proved that you can resuscitate a moribund art program by injecting low-cost materials,” says Zobel. “Hopefully we can help science teachers, too, who often buy classroom supplies with their own money. Who knows—maybe soon we’ll be able to reach beyond California and bring the whole nation our low-cost science kits made entirely of materials diverted from landfills.” **ESS**

For more information or to get involved with Trash for Teaching, visit www.trashforteaching.org.

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