A self-sifting composter, a novel oil filter cleaner: service learning challenges students to solve real problems with innovative, hands-on solutions

In Product Engineering Processes – 2.009 and Solving Real Problems – 2.00B, students work in teams on projects that benefit the community and the environment.

Composter team member Troy Tamas (’10, Course 2) tests the "grating" mechanism that allows the compost to fall through the wire mesh.

The raised composter with aeration tubes allows the compost to decompose quickly.

Composter team members Arthur Petron (’08 Course 2), Natasha Sivananijai (U), and Laura Martini (’08, Course 2)

Photo: Barry Kudrowitz Photo: Courtesy of 2.00B Photo: Monica Rush
Last spring, a team of six engineers in Solving Real Problems – 2.00B designed, built, and installed a cylindrical composter that generates quality compost in 1-2 months, requires no turning, and takes up very little space. Designed for The Food Project, a non-profit farm whose mission is to engage youth through organic agriculture, MIT students learned the basics of the design process by adapting the composter to the farm’s requirements.

In Product Engineering Processes – 2.009 another team of students designed an affordable system for extracting oil from oil filters so they can be safely recycled. Targeting small auto shops that often throw away their filters – leading to serious water contamination around the landfills – rather than properly recycling them, Cyclos removes 30% more oil from the filter in a 2-minute cycle than regular gravity draining which can take up to a few days and leaves oil residue in the filter. The two service learning classes – 2.00B (a design option for freshman and interested upperclassmen) taught by Dan Frey and David Wallace, and 2.009 (a Course 2 senior-level design class) taught by David Wallace – demonstrate the benefits for all involved: students are inspired by what they can accomplish and motivated by the tangible course outcomes. Beyond the lasting environmental benefits, kids on an urban farm have a composter that is easy to use and auto mechanics can responsibly, legally, and economically dispose of their used oil filters.

Since 2001, roughly 1,700 MIT students have participated in service learning classes taught by 57 instructors. From a refrigerated backpack that transports vaccines to remote locations – a device used by the World Health Organization (WHO) – to a humanitarian demining device, service learning classes address community needs while students reap the rewards of engaging more deeply in real-world challenges.

Laura Martini, a senior in Mechanical Engineering who was a team leader for the Cyclos team in 2.009 and was also on the composter team in 2.00B answered some questions about the two classes.

What was the difference between the two classes?

In 2.00B “you will build x” was already defined, whereas in 2.009 you define the problem. In 2.00B, the entire group was able to meet with the client and we worked a lot to identify [the farm’s] needs. In 2.009 there were 18 students so we had to rely on a couple of key people to speak with our customer and relay their needs back to the team. That’s

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What I took away: seeing how design can impact the community and how you can really improve the situation for various people.

What was the hardest part of 2.009? It was definitely a challenge coordinating 18 people who all had their own ideas of what they wanted the project to be. It was difficult getting [it to come] together in one project. The mechanical part was actually quite difficult, and getting it to function at all was a big challenge.

Was there anything you weren’t able to achieve in 2.009 and why? There were a lot of ideas that we had to abandon, which is just part of the design process. For example, we looked into melting plastic bags into sheets for construction, and after we put a lot of time and effort into making some prototypes, we realized we weren’t really going to be able to achieve a lot with it beyond what other people had already designed.

Can you tell me more about Cyclos? With Cyclos, it takes about a minute for the machine to automatically punch a few holes in the filter and spin it. Afterwards only about 20% of the oil remains in the filter. At an estimated price of about $700, Cyclos would be cheaper than industrial crushing machines, which run into the thousands of dollars.

How did your team improve the composter? Their old [composter] was just a big wooden square which required a lot of work to turn. None of the kids liked this task, and as a result of all of the hard work it required, the turning didn’t get done very often. They also didn’t like the job of sifting the compost so that large pieces of material that hadn’t decomposed yet would be put back into the composter instead of being spread onto the field.

Our design solved these problems with a couple of neat solutions. First, we added aeration tubes so that the compost would decompose quickly without needing to be turned. Second, because our design was raised off the ground, it allowed people to take the decomposed compost directly from the bottom, rather than needing to dig through layers of decomposing vegetable matter to reach the compost. Finally, because all of the compost [had to] pass through a wire screen, there was no sifting step; the sifting happens automatically as the client is removing the compost. You can think of it as a big flour sifter; any flour that makes it through has got to be a certain size.

Did this class affect your future plans (personal or academic) in any way? It confirmed that I’m interested in doing product design. It came at a good time, right at the beginning of senior year when you have to apply for jobs and grad schools.

Tish Scolnik (’10, Course 2) conducted this interview.

A Closer look at Cyclos

<table>
<thead>
<tr>
<th>Regular Gravity Drain</th>
<th>The Cyclos Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% of oil is removed</td>
<td>80% of oil is removed</td>
</tr>
<tr>
<td>takes 24 hours</td>
<td>2-minute cycle</td>
</tr>
<tr>
<td>creates hazardous waste</td>
<td>used filter is recyclable</td>
</tr>
</tbody>
</table>

Did you know these statistics?
a single improperly discarded oil filter can contaminate **62,000 gallons** of drinking water.

**450 million filters** are discarded every year, 80% in landfills, wasting 25.5 million gallons of recyclable oil and 230 thousand tons of steel.

About The Food Project

 Teens from diverse backgrounds work together on a farm to grow nearly a quarter-million pounds of food without chemical pesticides, donating half to local shelters. To insure the safety of produce grown in the urban lead-contaminated soil, they must replenish the top two-feet of soil with compost.

Over a hundred teens and thousands of volunteers farm on 31 acres in Lincoln, MA. The Food Project has a land base of 2 acres in Dorchester and Roxbury.
David Wallace explains his interest in service learning

Winner of the Baker Award for Excellence in Undergraduate Teaching and the Bose Award for Excellence in Teaching in the School of Engineering, Professor David Wallace, a MacVicar Faculty Fellow, reflects on service learning at MIT.

How do you think service learning fits with the MIT culture?

MIT is really about applying engineering and science to do things. Service learning provides the opportunity for students to be innovative and apply their work to make a difference for members of the community.

Why do you like to use service learning?

Most students want to have a positive impact in society. Service learning teaches students that they can dramatically impact people’s lives as innovators. Service learning also motivates students to engage and really learn the material being taught, builds confidence, and encourages students to continue to innovate and make an impact throughout their lives.

Has service learning changed the way you approach research?

Service learning has inspired a number of appropriate technology and socially-minded theses in the lab. The challenge is that these projects are harder to fund.

How has service learning affected the students you teach?

Service learning really helps to build student confidence. Many students enter the class not convinced about why they’re doing engineering. They exit the class with a much clearer sense.

Many students say meeting clients brings their project to life. For example in 2004, the 2.009 Kool Pool presentation bought tears to some audience members eyes because it was clear how effective the project was for the developmentally disabled students that were using it. Blue Steel, another 2.009 project, was a similar success story. Really broadly applicable social ideas when attached to real clients and real projects profoundly affect students.

Many students exit 2.009 wanting to make a positive difference by pursuing less traditional design careers in design for under-served clients. I’d like to help them identify relevant professional opportunities.

Camilla Shannon, Coordinator of Service Learning at MIT, conducted this interview.

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A breath of fresh air

New challenges by alumni spur MIT student innovation

Most MIT undergraduates engage in public service through the Public Service Center. Typically between 2,500 and 3,000 undergraduates and several hundred graduate students a year participate in service through PSC programs and services: becoming Public Service Fellows, joining an IDEAS Competition team, working through a grant-funded group, doing Community Service Work-Study, volunteering, or engaging with communities in other ways. MIT student interests are very diverse, and their capacity for positive change is limitless. Most of the time, we simply help them along the path they choose.

Last year, however, we launched the Yunus Challenge, named after Nobel Peace Prize winner Mohammed Yunus, to focus MIT students’ attention on the issue of poverty alleviation. The first Yunus Challenge issue was compliance with tuberculosis drug regimens. The results were inspiring, as the adjoining article indicates. Not only uBox, but other solutions as well are advancing through field-testing stages toward becoming applied solutions.

This year’s Yunus Challenge will focus MIT students’ attention on the issue of indoor air pollution in the developing world. Cooking is an integral part of culture, but cooking smoke contributes significantly to death from respiratory infection in many regions. As with last year’s Yunus Challenge, MIT students will have to apply their ingenuity to human factors as well as technical challenges in order to solve this pressing problem.

Other donors have recently followed suit by starting exciting Challenges of their own. The Student Global Energy Challenge is a great example, motivating students to work on energy consumption and production issues in the US and abroad. In my view, these Challenges are, sometimes literally, a breath of fresh air, as they exemplify how ingenuity from donors and students alike can help us to live in a cleaner, healthier, more hopeful world.

Sally Susnowitz
Director, Public Service Center

Yunus Challenge

The world takes note of the uBox, and field tests are underway.

The effects of last year’s Yunus Challenge to increase adherence to tuberculosis drugs in rural areas are still being felt today. The uBox, a smart pillbox that reminds patients to take their TB medication, keeps track of when they do, and locks itself to prevent double-dosing, was developed for the Yunus Challenge. The team won an IDEAS Competition award, and D-Lab students helped to engineer the pillbox. The team later received a grant and a fellowship from the PSC.

Field tests of the product began in Bihar, India, this past January.

The uBox has been featured in news sources including The Boston Globe and Inventorspot.com after David Chandler published an article in MIT’s Tech Talk.

The uBox team, Innovators in Health, includes Manish Bhardwaj (G, Course 6) and Goutam Reddy (’02), Oliver Venn (’08, Course 10), Sara Cinnamon (SM, ’04), Jayodita Sanghbi (’07), and Bill Thies (G, Course 7).

The IDEAS Competition involves 150 – 200 participants annually.
Need It, Think It, Build It, Space Exploration

Matt Gethers develops an engineering curriculum for Tutoring Plus’s program, Future Engineers

How do you propel a spacecraft into another galaxy? Or rather, how do you come up with a new propulsion system given what you already know about existing propulsion systems, black holes and meteor showers? That is the challenge Matt Gethers (’09, Course 20) has assigned the 7th and 8th graders participating in Future Engineers, a program Matt developed for Tutoring Plus in Cambridge. The 8-week program, beginning in April, which includes a field trip to the Chandra Operations Control Center, emphasizes the creativity and ingenuity inherent in engineering.

With a PSC summer housing grant that covered Matt’s residence hall costs in exchange for 20+ hours per week of community service work, Matt developed the curriculum for the Future Engineers program. He also created a library of problems based on key academic strands in the Massachusetts Curriculum Framework for Science, Engineering and Technology.

Since then, Matt has volunteered his time weekly to refine the curriculum. He has also recruited another MIT student to volunteer with him.

Summer housing grants are funded by the Dean of Student Life, Larry Benedict. Each summer, four to six grants are given to MIT students to support intensive community service work.

Collective wisdom

New Leadership Council to help guide the PSC

The Public Service Center (PSC) will celebrate its 20th anniversary in fall 2008. Our substantial growth over the years has been driven by MIT students’ passion for public service and enabled by the support of hundreds of friends and donors around and beyond the Institute. Recently, a select group of those friends has agreed to work with us as the PSC Leadership Council. They will convene every April and November to help us consider how to enhance the PSC’s sustainability and growth, think about how best to meet MIT’s changing educational needs, and strategize about how to increase MIT’s public service impact around the Boston metro area, around the US, and around the world.

Inaugural members of the PSC Leadership Council are Priscilla and Paul Gray (co-chairs), Paul D. Edelman (’78), Tabetha Hinman, Medha Karve, Kaia Miller, Agha Mirza (’94), William Putt (’59), James W. Taylor (’65), Ellen Turner, and Victor Tyler (’55). They bring a very welcome set of diverse life experiences, connections to the Institute, and ideas about how the PSC can move into its next 20 years of even more exciting and effective initiatives.
ScienceExpo

*Tuesday, April 29, 2008, 4 to 6 p.m.*
Johnson Athletic Center

**MIT IDEAS Competition Awards Ceremony**

*Thursday, May 1 at 7:30 p.m.*
Stata Center, Building 32

Kelly worked with the Diane Fossey Gorilla Fund International in Bisate Village, Rwanda, to develop improvements to a rainwater harvesting device. This work resulted in a cleaner domestic water supply for village residents.

"By the end of our trip, my teammate and I could explain in the local language (Kinyarwanda) what our setups were doing and how our work would eventually improve the local drinking water quality; people were intrigued and grateful for our help. It was wonderful to share our education with complete strangers who became good friends.

Kelly Doyle, G, Course 1
IAP 2008, Public Service Center Expedition Grant Recipient