Annual Report
2016-2017 Academic Year

Kids can... Think. Discover. Solve. Invent. change the world.

Tufts University | Center for Engineering Education and Outreach
For the past six years, I have had the absolute privilege to be a part of such a wonderful program as STOMP. The constant through that time has been STOMP’s commitment to students and teachers. Every year, STOMP fellows work tirelessly to bring engaging engineering activities to local schools at no cost to the school. But as my journey with STOMP comes to a close, I am able to reflect on the positive impact STOMP has had on me and on my peers as well. As an engineer, I have become more engaged in the classroom as I tried to find ways to explain the content to my students. As an engineering student in the classroom, I gained a deeper appreciation for the professor after I experienced running a lesson myself. I look at each semester of STOMP as a ten-week, open-ended project for two STOMP fellows to solve collaboratively. The students are the clients. The classroom teachers are the stakeholders. Success is measured in learning goals and student enthusiasm. Engaging in that process semester after semester has allowed me to contribute to the community surrounding Tufts while growing as a student, engineer, public speaker, and teacher.

As STOMP manager, I have done everything in my power to maximize STOMP’s outreach that lies at the core of the program’s values, and I am proud of that contribution. We have extended our reach by 50 percent more classrooms while hiring seven fewer fellows over the past two years. This is only possible thanks to the increased commitment from each and every one of our STOMP fellows. As applying to STOMP to be a fellow has steadily become more competitive, we have held all of our fellows to higher standards of work ethic and quality of curricula. As you will see throughout this report, they have more than met those expectations. The executive board, especially, has stepped up and taken on more responsibilities in their respective positions and as Squad Leaders. CEEO Education Specialist and former STOMP executive board member Alex Pugnali has continued to provide vital support to the program by reworking the Shadow Program into a much improved Residency Program, ensuring a steady stream of new but experienced fellows into the program.

I am so grateful for my time with this amazing program, and I will miss all of my STOMP fellows dearly. I have every bit of confidence that they will maintain the standard of excellence of this program as they continue to provide strong engineering activities to students and teachers in the community.

All the best,
Devyn Curley
Program Manager
Who We Are

What is STOMP?
The Student Teacher Outreach Mentorship Program (STOMP) trains Tufts University students (fellows) to teach in K-12 classrooms of the greater Boston area. The mission of STOMP is to improve K-12 education through engineering with a strong partnership between educators and university students. Through this classroom collaboration, K-12 students engage in meaningful engineering work with positive STEM role models while educators learn technical skills. University students gain first-hand education experience, as well as engineering enrichment as they must truly master technical concepts in order to teach them effectively.

STOMP was founded at Tufts University in 2001 from a generous three-year gift from the LLL Foundation. As part of the initial funding for STOMP, the LLL Foundation asked that STOMP investigate the sustainability and dissemination of such an engineering education outreach program model. By maintaining low overhead, the Tufts University program can sustain a large number of fellows on a small budget. Since 2001, STOMP has maintained a strong presence in the local community and has reached over 3,500 K-8 students.

The ‘S-T’ in STOMP: A Student-Teacher Team
Both members of the fellow-teacher team uphold a responsibility to contribute their respective expertise to the program and support each other’s roles. The fellow’s role is to enhance the engineering knowledge of the teacher and students including developing a curriculum with hands-on engineering activities, creating resource materials, and providing assistance in the classroom. In turn, the responsibilities of the teacher include helping the fellow become familiar with working in a classroom setting, and integrating engineering across disciplines taught in the classroom.

How Does STOMP Work?
Fellows are paired based on experience, with new fellows matched up with more experienced ones. Together, fellows work with a classroom teacher at a local school to create a ten-week curriculum, implemented in once-a-week, hour-long visits to the classroom. Fellows are trained in working in a classroom and implementing engineering design-based lessons by their more experienced partner and through weekly meetings with the entire program. Weekly meetings provide opportunities to introduce new lessons, listen to guest speakers, discuss progress and problems in the classroom, plan for upcoming classes, and run other professional development workshops.

Who We Are

STOMP Management

Executive Board

Graduate Student: Jhanel Chew
Class of 2017: Brian Bertini, Erynne van Zee, Kirsten Jorgensen, Rachel Kramer, Rebecca Larson, Sara Pearce-Probst
Class of 2018: Azmina Karukappadath, Camila Menard, Chris Keyes, Erica Albert, Liren Fu
Class of 2019: Avni Rajpal, Clara Oppenheimier, Declan Devine, Iris Oliver, Jared Sawyer, Tessa Garces, Winnie Zheng Yao Lin, Alex Klein, Caroline Passalacqua, Clara Eshaghpour, Edward Futterman, Elizabeth Dossett, Emma Cusack, Kevin Dunn, Kristina Chu, Mile Kristev, Oriam Sneeor, Ross Kamen, Sanya Pradhan, Shelley Kwok, Sonja Hartmann
Class of 2020: Allie Webster, Christopher Camacho, Elizabeth Moison, Heresa Laforce, Isaac Collins, Jessie Duggan, Jesus Garcia, John Fernandez, Justin Reyes, Ralia, Raul Gomez, Ryan Eccleston-Murdock
Who We Are

Executive Board Positions

Publicity

Emma Coltoff
My role is to manage STOMP publicity at Tufts and at local community events. I respond to email requests to attend science fairs, exploratory learning events, STEM nights, and other kid-oriented events to bring our creative STOMP materials and to advertise on behalf of STOMP and the CEEO. I communicate with event organizers and manage volunteers from STOMP as well as make sure all of the materials and transportation we need are prepared for the event. I also work with other Tufts groups to represent STOMP at events on campus and to organize combined events, such as Girls Fix the World with SWE.

Shannon Geary
As a STOMP publicity coordinator, I am in charge of fall recruitment and spring advertisement of STOMP to incoming students. I am responsible for organizing volunteers and resources for outreach events at local schools and on campus at the CEEO throughout the year, as well as working with the CEEO to publicize the STOMP organization in the community.

Residency

Eva Phillips
As a member of the STOMP Executive Board, I am the STOMP Residency liaison. This means I am in charge of overseeing and organizing the residency fellows exposure to the STOMP Fellow Program. I also monitor the transition of individuals from the Residency Program to the STOMP Fellow Program.

Rati Srinivasan
The STOMP Residency Program logistics coordinator works as part of the Residency Trio to guide the ten students selected for the Residency Program. This position involves sending out bi-weekly update emails, helping to coordinate student schedules for workshops, and serving as the squad leader for the residents.

Website Management

Camille Mbayo
As webmaster, I am in charge of cleaning up and merging the different websites. I am also responsible for updating the list of curricula, STOMP fellows, and the resources. I am also in charge of making sure that the information on the website is up to date.

Curriculum Development

Katherine McMurray
As curriculum coordinator, I am a resource to STOMP fellows for curriculum development via email and office hours at the start of the semester. I am also responsible for creating documents to help guide STOMP fellows as they develop their curricula, such as the Curriculum FAQ Sheet, and for planning and leading curriculum development focused Wednesday meetings.

Logistics

Caitlin Duffy
My main responsibility each week is finding subs for STOMP fellows who have to miss their STOMP classes. When the STOMP fellows’ weekly Tufts schedule is available, I narrow down the list of people who are free to sub during a certain time period and email this smaller group instead of STOMP as a whole. Other responsibilities whose time commitments vary from week to week include planning out Wednesday meetings, updating the STOMP calendar, and collecting photo release forms. Other odd jobs relating to logistics are assigned throughout the semester, and Tommy and I tackle those as they come along.

Tommy George
As one of STOMP’s two logistics coordinators, my main responsibilities are related to the STOMP closet in the CEEO. All kits used in STOMP classrooms, such as LEGO robotics, snap and squishy circuits, laptops, and Makey Makeys, are reserved through me, and I make sure that the kits are returned in time for other STOMP fellows to use them. I also send informational emails to the STOMP elist, updating STOMP fellows on Wednesday meetings, volunteer opportunities, logistical changes, and upcoming deliverable deadlines.
Who We Are

STOMP Statistics
The scheduling system implemented last year in an effort to extend outreach without increasing salary costs proved to be sustainable and was able to scale further. Including all the STOMP fellows, 58 taught in 43 classrooms in the Boston area, impacting over 850 students!

The general makeup of the fellows maintained just under a two to one ratio of females to males, which is highly unusual in a group comprised of mostly engineering students. Of the thirty-six female STOMP fellows, twenty-three are engineering students. Therefore, 40 percent of STOMP fellows are female engineering students. This is a greater percentage than the total female population in the School of Engineering. The 35 engineering students in STOMP make up 60 percent of the program. As we look toward the future, it is very promising to see 67 percent of our fellows in the freshmen and sophomore classes. All thirty-nine of them have already contributed greatly to the program, and are eager to take on more responsibilities.

Meeting Schedule Fall 2016

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>9/21</td>
<td>For the first meeting of the new school year, returning STOMP fellows came together in small groups to discuss the importance of STOMP, why we make time for it, what impact we make, and what greater impact we want to make in the upcoming year.</td>
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<td>9/28</td>
<td>New hires finally having been solidified, the manager laid out expectations for all STOMP fellows, and distributed the STOMP Fellow Contract. STOMP Squads were also announced and met for the first time.</td>
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<td>10/5</td>
<td>As STOMP pairs began developing their curricula, the timing of this meeting was important to provide relevant professional development. Experienced STOMP fellows shared successful curricula of the past, and Squads engaged in an activity development exercise.</td>
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<td>10/12</td>
<td>STOMP fellows toured the makerspace in Bray and brainstormed how they can leverage it in their classrooms.</td>
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<td>10/19</td>
<td>Executive board members presented on co-teaching practices as new pairs find their rhythm. This was put into action in the second half of the meeting with an improvisation activity to encourage STOMP pairs to think on their feet and practice handling unexpected challenges in the classroom.</td>
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<td>10/26</td>
<td>Devyn and Eva presented on practices to teaching and scaffolding the engineering design process. Graduate student and former STOMP fellow Matt Mueller presented on his MakerGames project as a potential resource for such scaffolding.</td>
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<td>11/2</td>
<td>Elissa Milto, Director of Outreach at the CEEO, presented to STOMP fellows about working with students who have special needs.</td>
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<tr>
<td>11/9</td>
<td>The bi-annual Knowledge Cafe brought STOMP fellows together in rotating groups to discuss how STOMP can improve in a variety of areas such as professional development, fellow and teacher expectations, and long-term goals.</td>
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<td>11/16</td>
<td>Professor Ethan Danahy came and talked to STOMP fellows about how to introduce and leverage educational technologies in their classrooms.</td>
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<td>11/30</td>
<td>Darryl Williams, Director of the Center for STEM Diversity and Associate Dean for Undergraduate Education for Tufts School of Engineering, led a meeting about addressing diversity and privilege. Fellows were encouraged to think about the identities they have, privileges that come along with them, and the impact they have on their work in classrooms.</td>
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<tr>
<td>12/7</td>
<td>For the last meeting of the semester, STOMP fellows enjoyed a well earned pizza lunch while they filled out a survey that featured additional questions to supplement Karen Miel’s research.</td>
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Meeting Schedule Spring 2017

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<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>2/8</td>
<td>With the Residency Program removing the need for mid-year hiring, STOMP enjoyed an earlier start than ever this year. For the first meeting, CEEO Director of Outreach Elissa Milto came in to go over techniques for handling difficult classrooms.</td>
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<td>2/15</td>
<td>STOMP fellows broke into squads to share curriculum plans for the semester and provide constructive feedback for each other.</td>
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<tr>
<td>2/22</td>
<td>Experienced STOMP fellows presented on previously successful curricula. Each presentation focused on a specific aspect of their curricula that they felt was exemplary or should be highlighted. STOMP partners utilized meeting time to take the feedback they received the week prior combined with the successful curriculum characteristics presented.</td>
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<td>3/1</td>
<td>CEEO graduate student and former co-manager of STOMP Jessica Swenson talked with fellows about young girls in STEM, and how to think critically about the lessons they were developing and how they could make them universally appealing and beneficial.</td>
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<td>3/8</td>
<td>For the last improv meeting of the year, executive board members set a strong example before breaking out into their squads and posed many different “think on your feet” challenges to their fellows.</td>
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<td>3/29</td>
<td>First meeting back from spring break, executive board members checked in with their squads over lunch to touch base and also further develop the squad community.</td>
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<td>4/5</td>
<td>This meeting was focused on how to challenge, engage, and empower students in order to promote deeper learning experiences in the STOMP classroom. Fellows were shown videos and read passages in order to understand teaching methodology developed by EL Education.</td>
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<td>4/12</td>
<td>A guest speaker from Tufts oSTEM presented on gender and sexual identity, proper pronoun usage, and how to be cognizant of different student identities. Then fellows played a game called Barnga, where the rules constantly change based on where you are in the game. We concluded with a discussion on what it means to be a minority, what it’s like to not have a voice, and how to be aware of these issues when working with diverse student populations.</td>
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<tr>
<td>4/19</td>
<td>In order for fellows to provide more complete feedback, the Knowledge Cafe was held at the end of the semester, with the same topics from the previous semester in addition to the topics of Residency Program and Logistics.</td>
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<tr>
<td>4/26</td>
<td>With Devyn away at the FIRST World Championships, STOMP executive board ran the last meeting of the year, distributing a survey for feedback and pizza for nourishment!</td>
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Highlighted Lesson

At the beginning of each semester, STOMP pairs plan a unique and engaging curriculum that aims to introduce students to new and exciting concepts in STEM fields while still being fun!

This curriculum, made by Mile Krstev and Jesus Garcia for a fourth grade classroom, is a perfect example of the goals and the hands-on lesson planning style that is characteristic of STOMP.

The overarching theme of this unit is energy engineering. The idea is to expose the students to the concepts of energy, matter, and energy transformations before they proceed to use the energy transformations for purposes of useful energy and power generation. The curriculum is divided in two parts: 1) exploration of energy transformations through data collection and experimentation, and 2) building an amusement park in which energy transformations will be used to generate power and maximize efficiency for running the amusement park. Two important additional components that we want to reinforce this semester are 1) group work, as a lot of the activities are tailored in ways that guarantee successful completion only through successful group work, and 2) recognition of women’s contribution to science, as female scientists will be introduced at the beginning of every new topic.

Lesson 1: LEGO Challenges & Engineering Design Process

Objective: The students will be put in situations in which working in groups can result in a more successful outcome. They will also be reminded of the engineering design process and how to take part in the activity while going through the process.

Activity: LEGO challenges. For round one, each student will get twenty-five LEGO pieces and will be asked to build, in one minute, the tallest freestanding tower using only those pieces. The second round will NOT include a restriction on LEGO pieces in order to motivate them to get in groups and to have more pieces and to build a taller tower. At the end, they will have to think of ways on how to improve their design to make it more wind-resistant and taller, if possible. The last activity is “Broken LEGO Phone,” the LEGO version of “Chinese whispers” or “Telephone,” in which every student will have LEGO to start building something they want. After two to three minutes, they will pass their structures onto the right without talking at all, and the person will have to guess what the structure was and continue to build.

Lesson 2: Energy & Matter

Objective: The students will understand the differences and similarities between energy and matter, as well as the connection between energy and matter. They will also learn about the different forms in which energy exists. They will also understand how temperature and joules are used to quantify energy.

Activity: The students will try to learn about the shape, volume, and rigidity of the different states of matter by observing the compression of a half-filled water bottle. The students will also observe the diffusion of food color in cold and hot water. They will try to come up with energy-related explanations about why the diffusion happens faster in hot water.
Highlighted Lesson

**Lesson 3: Mechanical Energy**
Objective: The students will understand the law of conservation of mechanical energy through experimentation. They will learn about the impact of elevation and velocity on potential and kinetic energy, respectively. In addition, they will get acquainted with basics of experimental data processing. Last, the students will experience the importance of teamwork in data collection.

Activity: As part of the series of female scientists that we will cover this term, we will talk about Chien-Shiung Wu, often referred to as “the First Lady of Physics,” who also worked on the Manhattan Project. The students will be divided into groups of five to six. Each group will receive a cardboard ramp, LEGO to build a car, measuring tape, protractor, and stopwatch. Their task will be to measure the distance the car traveled, the initial elevation, and the time the car moved for six different angles.

**Lesson 4: Friction & Energy**
Objective: The student will understand the impact and role of friction in energy conservation. They will learn about the energy transformations that result in heat due to friction. Moreover, they will further practice data collection through the car ramp experiment.

Activity: The students have already learned about conservation of mechanical energy. Now, they will explore the reasons behind the car coming to a stop while still applying the law of conservation of energy. The students will do a continuation of last week’s activity with the ramp. However, this time they will keep the ramp inclination angle fixed while varying the mass of the car and the amount of friction between the car and the ramp.

**Lesson 5: Hydropower**
Objective: The students will understand how power can be generated using water and also get an insight into the energy transformations that take place during electricity generation in dams.

Activity: The students will try to implement the concept of conservation of energy in this scenario, by analyzing the kinetic and potential energies in a water wheel setup. They will also be introduced to Rosalind Franklin, another female scientist who did not receive the credit she deserved for the work she did.

**Lesson 6: Magnetism**
Objective: The students will understand the basics of magnetism—how magnets work, north and south poles of magnets, permanent and temporary magnets, how to determine relative strength of magnets based on field lines, and what electromagnets are.

Activity: This is the introduction to a new type of energy and power source—electromagnetic energy. They will learn basic concepts needed for understanding induction, which will be taught next lesson. They will also learn about Mary Somerville, a scientist from the late 18th and early 19th century who wrote about electromagnetic waves. Toward the end of the lesson, the students will be allowed to explore the magnetic properties of several types of magnets and magnetic materials: magnet rods, neodymium magnets, and iron powder. They will get to test how many paper clips they can lift with the different types of magnets, and use that as a relative measure of magnetic strength.

Highlighted Lesson

**Lesson 7: Electromagnetic Induction**
Objective: The students will understand how electromagnetic induction works and how it is used in generating electricity for commercial use. They will also learn about obstacles in transferring concepts from a small scale to a large scale, with electricity transmission as an example.

Activity: The students will have learned about magnetic fields around conductors (electromagnets), so now they will investigate the reverse scenario—creating electricity using magnetic fields. The students will make circuits with LEDs and/or light bulbs, which will be powered with current produced from electromagnetic induction.

**Lesson 8: Nuclear Energy**
Objective: The students will understand how nuclear fission can be used to produce energy at high efficiency rates. They will also think about the danger associated with nuclear power and get an insight into evaluating trade-offs between risks and benefits.

Activity: Having learned about simpler energy generation methods, the students will learn about energy generation based on atomic interactions. This will be the last energy type covered. They will also learn about Marie Curie, one of the most well-known female scientists who did research with radiation.

**Lesson 9: Amusement Park: Brainstorming and Planning**
Objective: The students will be encouraged to use the newly acquired knowledge about energy transformations and different forms of energy in a given situation, in this case an amusement park. They will also understand the importance of cohesiveness and organization when working in groups on a large-scale project.

Activity: They will be tasked with building an amusement park that will have at least five components and incorporate three types of energy that we have covered. The whole class will build one amusement park, thus each group will work on a different component/ride. The five most suggested components will be the ones that the amusement park will consist of.

**Lesson 10: Amusement Park: Building**
Objective: The students will gain hands-on experience in design based on energy. They will understand that there are differences between theoretical and experimental scenarios, and will learn to readjust their goals and plans based on circumstances. They will also practice task delegation and communication in groups.

Activity: After the students in each class decide what their amusement parks will be made of, we will assign a specific number of students and a level of difficulty to each component. Because they will be working together for two to three weeks, it is important to have intentionally made groups in order to maximize the learning experience of each student. A key idea that the students will be reminded of is how the whole amusement park belongs to all of them, thus they should not compete but work toward a common goal.
Lesson 11: Amusement Park: Final Touches

Objective: The students will learn how to accept constructive criticism and to respond to it by making improvements to their designs. They will also practice time management since this will be the last time they will be able to work on final touches to their projects.

Activity: At this point, almost all groups will be finalizing their components. We will comment on each group’s work and suggest possible improvements. These will mainly relate to the energy/power side of the amusement park components. The students will be expected to respond to the comments by improving their components in the remaining time of the lesson. At the end, the students will be introduced to the presentation format for the amusement park—a TV commercial to appeal to potential visitors.

Lesson 12: Amusement Park: Presentation and Commercial Filming

Objective: The students will understand the importance of effective communication in engineering, i.e., the ability to explain complex ideas using simple vocabulary. In addition, they will practice democratic decision making in large groups. Last, they will improve their marketing skills by thinking of ways to “sell” their idea, in this case the amusement park, to a target audience.

Activity: The whole class will vote on a name for the amusement park. Anyone will be able to propose ideas that will be put to a vote. Then, they will need to come up with names for each component/ride (ideally catchy names that will appeal to visitors). Members of the group building a specific component will be able to propose names for the particular component; however, the whole class will then vote on those ideas. Someone will be in charge of introducing the amusement park at the beginning of the commercial. The commercial should be around three minutes long. At the end of the lesson, the students will receive certificates for successful completion of this course in energy engineering.

Where We’ve Gone

Checking In with STOMP Alumni

Riley Meehan
BS in Mechanical Engineering 2013
MS in Elementary STEM Education 2015

Early in my undergraduate career at Tufts, I felt that I needed to find outlets to take my engineering knowledge outside the classroom and find ways to connect to the Greater Boston Area community. I was incredibly fortunate to find STOMP as a venue for accomplishing both of these aims. Looking back almost eight years now, it is pretty clear to me that my experience in STOMP was integral in setting me on the path to where I am today.

While an undergraduate at Tufts, I was fortunate to have a variety of opportunities to employ what I learned in my engineering courses outside the classroom. I spent three summers designing components for imaging spectrometers at the Jet Propulsion Laboratory, I worked in several labs as a research associate designing and fabricating components for biomechanical engineering research, and I was able to spearhead a design project to prototype an automated solar panel cleaner from paper to functioning prototype. My engineering education at Tufts was well-rounded and full of real-world application. However, upon graduation, it was my experience with STOMP that remained my driving force, which led me to pursue a Masters in STEM Education at Tufts with the Center for Engineering Education and Outreach.

These days I am in San Diego at High Tech Elementary, a Title I project-based learning school, where I get to lean on the experience and knowledge that I gained through STOMP every day. I joined High Tech Elementary as a founding faculty member with the opportunity to start their K-5 engineering program—a program that services all 410 students from kindergarten to fifth grade. This year, I am taking on a new role straddling both sides of research and practice as a part-time engineer and part-time researcher. The research conducted at High Tech Elementary will be in service of supporting elementary engineers and elementary teachers seeking to provide their students with the same high-quality engineering education that STOMP offers schools in the Greater Boston Area. There is no question that STOMP was an integral component of my undergraduate education that opened my eyes to the value, importance, and reward of working alongside students and teachers in engineering projects.
Events
Halloween on the Hill
This year, STOMP set up a table for the Leonard Carmichael Society (LCS)’s event, Halloween on the Hill. Each year, Tufts hosts hundreds of local children from Medford and Somerville for a day of costumes, trick-or-treating, and fun and games! In pairs, Tufts volunteers lead a group of five to ten kids around campus and the surrounding Tufts community to tables where kids complete events, make crafts, and have fun! Halloween on the Hill is one of LCS’s biggest events during the year, and this year the STOMP table included a lot of fun activities.

STOMP is geared toward making the most out of student learning in new and engaging ways, so Halloween on the Hill was a big success! At the event, trick-or-treaters would come up to our table and had to complete challenges if they wanted Halloween candy! For one challenge, kids had to make a light bulb light up using only a battery and play dough. The more complex they could make their circuit, the more candy they could earn! The trick-or-treaters loved it! Although we had a few hesitant kids come to our table at first, once we explained how it worked, they were quickly making circuits that could light up multiple light bulbs at once! One student even made parallel circuits with their play dough!

Halloween on the Hill is an event that STOMP fellows always have a great time staffing. It’s an easy way to demonstrate how much fun engineering can be, and the kid-centered focus is what STOMP is all about. Not only is it good practice for STOMP fellows on how to teach lessons quickly, but it’s also a great way to engage students with engineering outside of the classroom. In the future, STOMP and LCS should continue to work together in this fun event!

Recruitment Success
Dining Halls
STOMP fellows are able to reserve table space in the lobby of the undergraduate dining halls for free at peak meal times to maximize the program’s exposure. Fellows manning the table capture the interest of soon-to-be diners with the various educational technologies we utilize in the classroom. Those interested in applying are able to submit their email to receive the application within twenty-four hours. This quick turnover between interest and application is a must to enter classrooms in a timely fashion in the fall.

Activities Fair
Tabling at the activities fair is an investment in the future. It happens too late in the fall to recruit for same semester applications, but the fair draws in such a large portion of the freshmen and sophomore classes, specifically students looking to find a community, job, or passion on campus. Similar to tabling in the dining halls, we leverage our LEGO, robotics, and circuitry to generate interest, with the added benefit of table guests not rushing to a meal. We make the most of this by providing short challenges for them to experience what STOMP looks like. Those interested submit their email for the next application cycle.
**Publicity**

**Kids’ Day**

This spring, STOMP partnered with the Leonard Carmichael Society (LCS) for their Kids’ Day event, filled with fun and games for local children. As one of LCS’s oldest programs, Kids’ Day has been bringing kids from Medford, Somerville, and Boston to campus for over fifty years. Volunteers partner up and lead a group of five to ten children around campus to all sorts of activities. STOMP had a table at one of these activity fairs, and we had almost as much fun as the kids did!

For Kids’ Day, STOMP used LEGO EV3 kits to challenge the kids, as well as a few Squishy Circuit kits. Squishy Circuits use play dough, batteries, and small LED lights to model circuits to young kids in easy, familiar, and fun ways. If students could make a circuit and get the light bulb to light, they would get a piece of candy as a prize. For the EV3 challenge, kids had to build a candy-scooping robot. Using the LEGO pieces we brought, they built robots that would scoop up as much candy as possible. To test, we scattered candy on the ground, and any pieces that the robot picked up the students got to keep.

Although the candy was an incentive, kids had as much fun building the robots and circuits as they did enjoying the delicious candy. The best part of the day was watching how excited kids would get when one of their robots worked better than they expected.

These kinds of fun, student-oriented activities are a hallmark of STOMP, and LCS’s Kids’ Day provided the perfect opportunity for community outreach in this way. STOMP fellows are a part of the program because they love teaching and engineering. Being able to participate in this activity was a great way to combine these passions with community outreach for a fun day that everyone enjoyed. We hope to continue this partnership with LCS next year!

**Jumbo Days**

STOMP recently participated in “Jumbo Days” on April 14, April 20, and April 21. Jumbo Days is an event held by Tufts University for admitted students. The purpose is to allow these high school seniors to explore the campus, meet current students, learn about different clubs and opportunities at Tufts, and even attend mock lectures held by current professors. Jumbo Days is a chance for the Tufts community to show accepted students what life as a typical Tufts student is like, as well as the vast array of opportunities Tufts can provide its students.

As an organization that thrives on student enthusiasm, Jumbo Days is an essential event for STOMP to be represented at. It is an opportunity to show potential freshmen what the STOMP organization stands for, what we do in terms of outreach in the community, and how to get involved in engineering education. Students come to Jumbo Days to learn about the types of clubs they can get involved in as an undergraduate, as well as how they can continue to explore their current interests in college (interests which very well could include teaching, robotics, or engineering design). STOMP uses Jumbo Days as a way to introduce and advertise the organization and its values to incoming students, as well as to represent the sorts of community outreach that Tufts as a university sponsors.

In the future, Jumbo Days will continue to be a main way that STOMP introduces itself to incoming freshmen, who often make enthusiastic, well-suited members of the STOMP fellow and residency member groups. It is also a method of advertising the goals of the STOMP program to the Tufts community as a whole. We must continue to disperse informational pamphlets, display different activities and technology that are used in classrooms, and promote the good that STOMP does for our neighboring communities. Jumbo Days is the best channel STOMP has for making itself a pillar of the Tufts community, and for continuing to convince enthusiastic students to join us!

STOMP fellows working the event reported that many people seemed very interested in what STOMP does as a program and how to join. One high-school student in particular even came up and excitedly asked if the volunteers were using Squishy Circuits (which were being set up on the table), and seemed to remember using them when she was a kid!
Great Expectations for Fellows

Acceptance Rate

STOMP’s presence and popularity on campus has been on the rise and there is no better measure of that than our applicant pool. Fifty-four Tufts students applied for thirteen available fellow spots for fall 2016. This 24 percent acceptance rate made for a very challenging selection process for Devyn, Alex, and the executive board. The Residency Program experienced a similar acceptance rate as there were only ten potential spots for the remaining forty-one applicants. The luxury of selecting the top 24 percent of the already strong pool of Tufts students resulted in a strong class of new hires. These new fellows were able to hit the ground running in the fall, each proving to be an asset and making a strong impact on the program right away. One of the reasons for this strong applicant pool is the tabling done by returning fellows in dining halls and at the activities fair.

As STOMP has continued to become more selective, our hiring standards have increased, and a product of such strong fellows, regardless of experience, is heightened expectations across the board. This manifests day to day in stronger curricula, better attended meetings, and participation in discussions. It also has had an overall impact on our outreach potential, detailed below.

One classroom per school year: STOMP fellows are now required to select their spring classes around their STOMP class, ensuring that the same pair can continue to build a rapport with their students and classroom teacher. Exceptions were made based on graduation requirements and flexibility of schedule, but they were few and far between. Of all STOMP fellows, 80 percent were able to teach in the same classroom from fall to spring semesters and produced incredible results. STOMP Fellows reported a much easier transition having experienced the classroom teacher’s management style, and the learning processes of the student. Moreover, STOMP fellows were able to build off of the curriculum they taught in the previous semester. This is a major change from previous years when a new STOMP pair would need to find out what was taught previously and make sure they wouldn’t be contrary or confuse the students based on lesson focus or terminology used.

Teaching in Back-to-Back Classrooms

The limiting factors for STOMP’s outreach have been money required to pay fellows, and scheduling the STOMP car. With the good word of STOMP spreading through schools, we received many applications from within the same school. This was used as a point of leverage to require less travel time with the STOMP car and for hiring fewer fellows. The manager coordinated with teacher applicants to schedule classrooms of a similar age group back to back. This way, one STOMP pair can travel to the school and back once, teaching the same lesson twice: there was no extra travel time, no further curriculum development needed, and just one extra hour a week and a single STOMP pair’s outreach is doubled. This proved to be beneficial for more than just scaling outreach. STOMP fellows felt much stronger teaching the same lesson on their second run through, having learned lessons during the first class. STOMP pairs with one inexperienced fellow used this second class as a perfect practice opportunity to provide more experience to new hires scaffolded by the experienced fellow setting an example in the first class. This process requires a great deal of coordination between teachers and the manager, and teaching stamina on the part of the STOMP fellows, but well worth the potential of doubling outreach without hiring a single extra fellow.

As a result of this new method, outreach has increased from thirty classrooms in fall 2015 to forty-three classrooms in spring 2017, while hiring six fewer fellows (sixty-three in fall ’15 to fifty-seven in spring ’17). This has taken our fellow to classroom ratio down from 2.1 to 1.33.

Diversity in STOMP

Review of Changes

During the 2016-2017 academic year, STOMP management began a focused effort to increase diversity within the fellowship program. The goals of increasing diversity were to create a more inclusive environment within the program, create spaces for racial minorities within STOMP; and to more closely match the STOMP fellows to the demographics of the schools in which they teach. Research shows that students of color perform better when they can see themselves in the teachers that they are working with. This point of research is incredibly important to STOMP considering that roughly half of the schools that STOMP fellows teach in have student racial minority populations of 50 percent or greater. Across all twenty schools, racial minority students make up 50.9 percent of the student population. Racial minority in this sense is defined as Asian, black, Latino, or multiracial.

Demographic Information

Had STOMP not undergone any significant changes in racial demographics, then the program would have remained at roughly three-quarters white, and only one-quarter minority members at the beginning of the fall 2016 semester. With the addition of the residency program and focused efforts to hire students of color and minorities to work as STOMP fellows, the fall of 2016 greeted a significant and positive change in STOMP diversity. Of all STOMP fellows, 52.5 percent were white, and 45.5 percent were a minority. During the spring 2017 semester, with the addition of a new group of residency fellows, the numbers changed again slightly. Of these STOMP fellows, 48.3 percent were white, and 51.7 percent were members of a racial minority group.

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Residency

Residency Program Mission

The STOMP Program began in 2001 with five fellows in two classrooms. The program has now expanded to fifty-five fellows working in forty-five classrooms across the Greater Boston Area. With the increase in popularity and success of the program, the admissions acceptance rate has decreased to less than 25 percent of applicants each semester. This means that only fellows with significant teaching experience are being accepted. The STOMP Residency Program was launched at the start of the fall 2016 semester to give students who don’t have much teaching experience, but have a passion for STEM education, the opportunity to join the STOMP program.

Part of the Residency Program mission is to increase diversity within the STOMP fellowship program as a whole. The goals were to create a more inclusive environment within the program, create spaces for racial minorities within STOMP, and to more closely match the STOMP fellows to the demographics of the schools in which they teach. With the addition of the residency program, and focused efforts to hire students of color and minorities to work as STOMP fellows, the fall of 2016 greeted a significant and positive change in STOMP diversity. Of the STOMP fellows, 52.5 percent were white, and 45.5 percent were a minority.

STOMP Residency Fellow Responsibilities

Students in the program have the opportunity to assist with workshops at the CEEO (Center for Engineering Education and Outreach). They get a semester of learning from experienced teachers, observing the implementation of STEM curricula, and even get the opportunity to teach their own lessons. Ten students participated last semester, and we will be accepting ten more this semester.

STOMP Residency Fellows work an average of five hours a week (some weeks closer to one and others closer to ten) and get paid (both work study and non-work study). These paid responsibilities include (but are not limited to) the following:

- Assist workshop leaders with K-8th grade workshops
- Register students, set-up and clean-up, work with small groups, etc.
- Teach two sessions
- Work with other residency fellows to develop and run a STEM workshop activity
- Partner with a pair of STOMP fellows to teach a one-hour lesson in a classroom
- Observe a STOMP classroom
- Attend Wednesday meetings from 12:00 to 1:00 p.m.
- Attend trainings

Supporting Tech

Curriculum Database Changes

A major focus over the summer was to restructure the STOMP website curriculum data, both organizationally, and in how the program uses it. As curriculum development has been included more and more in professional development, STOMP fellows are designing curricula that we are really proud of and want future fellows to use, along with classroom teachers seeking resources and ideas. Experienced STOMP fellow and summer intern Laura Fradin went through the whole curriculum database in an effort to reorganize the entire system.

The first target area was to combine all duplicate activities into one “best of” activity. In doing so, the most popular version was highlighted and fleshed out thoroughly, while other variations were noted as possibilities for STOMP fellows who want different options. Once all duplicates were combined, each lesson was put into one of three categories. One category was for the few poorly written and not well though-out lessons that do not have the potential of meeting the CEEO’s standard of engineering education. On the other end of the spectrum, we had a category of all-star lessons: those that have been taught and refined year after year throughout the history of the program. These “STOMP Staples” were cleaned up and refined to be published to the public and serve as resources for teachers. These were compiled and put into their own section of the website for easy access for teachers and for STOMP fellows who are looking for a strong lesson to include in their curriculums. The final category is right in between the others: pending activities. Pending activities are only accessible by current fellows, and while they show a lot of potential, have unique concepts, or interesting learning goals, they require more field testing to strengthen their flow or pedagogy. Fellows, especially ones with more experience, are encouraged to incorporate these into their curriculums and document their experience. If a pending activity is tested and refined it can be transfer to the STOMP Staples list, or if multiple fellows find issue with the activity it will be scrapped to make space for new ones. Each summer the STOMP intern will go through the past year’s new activities and comments on the pending activities and organize them accordingly, ensuring an annual influx of new curriculum ideas.
Making, Teamwork, and Participation in Engineering

This year, our research focused on the ways in which STOMP supports K-8 students in learning engineering. We observed and video-recorded over forty lessons in six classrooms and three schools, and looked at interactions among STOMP fellows, classroom teachers, and K-8 students. Three themes guided our research this year: the efficacy of the Portable Maker Workshop, scaffolding teamwork, and inviting participation in engineering.

Portable Maker Workshop: Greater Access to Tools and Materials

Two classrooms incorporated the new Portable Maker Workshop in their engineering lessons. Developed by Tufts University’s Dr. Kristen Wendell, the PMW is a compact collection of tools and materials designed to provide students with tangible resources to solve engineering design challenges. The abundance and variety of materials were particularly impactful for students; they creatively tested various supplies and compared the characteristics of materials to choose the best materials for their projects. Additionally, the abundance of and easy access to supplies promoted student agency and independence; students leveraged their growing familiarity with and access to tools and materials to creatively problem-solve on their own and with their teammates. In these classrooms, STOMP fellows were no longer tied to managing materials, which enabled them to spend more time facilitating teamwork. The findings from this portion of the research will help to develop the PMW into a resource that will allow schools with limited resources to engage in the Maker movement.

Scaffolding Teamwork

In the classrooms that participated in research, STOMP fellows emphasized two facets of collaboration; at times STOMP fellows framed collaboration as a process of generating, sharing, and refining ideas. When fellows focused on both facets of collaboration, students advanced their engineering practice. Notably, emphasizing sharing and refining ideas (with or without emphasizing social cohesion) promoted engineering design work by students. Specifically, when fellows encouraged groups to exchange and refine ideas, those groups generated multiple solutions to design challenges, evaluated and refined these design ideas, and purposefully chose a solution idea to pursue.

Teachers commented in research reflections that STOMP provided an important time and space for students to practice working in teams. During STOMP classes, students said that working in teams was hard at times, but that they appreciated having classmates to help envision and realize ideas. These findings will be used to hone the STOMP program to facilitate teamwork in ways that encourage K-8 students to exchange ideas, refine ideas, and deepen their engineering learning.

Inviting Participation

We looked at the ways in which STOMP fellows invited students into engineering. In our analysis of interactions, we identified three different ways that STOMP fellows tried to include students: verbal, physical, and social types of invitations. As we’d expected, verbal invitations, such as a STOMP fellow asking, “Will you tell me about your design ideas?” encouraged students to participate in engineering activity. We had not anticipated physical invitations such as instances in which fellows invited participation by placing materials directly in a student’s hands or by co-building with a student. When students were not already participating in engineering-related activity, physical invitations successfully drew students into engineering work, including generating and testing design ideas.

Social invitations were future-oriented: STOMP fellows combined stories of their own love of engineering with encouragement for students to consider engineering careers. We plan to look for connections between this type of invitation and students’ engineering aspirations and interests. These findings help to refine the STOMP program, and we will share these findings in research publications that will help other programs broaden student participation in engineering.

Looking Forward

We are grateful to the schools, teachers, students, and STOMP fellows who participated in STOMP research this year and last year. You expanded understanding of how K-8 students learn engineering and how schools and universities can partner to support and advance the teaching and learning of engineering. The information we learned helped us make it to the final round in a National Science Foundation grant program. We expect to hear this summer if we have been awarded a grant to study how STOMP fellows could serve as role models who inspire elementary students to enjoy engineering and consider future engineering careers. Thank you for your invaluable work and support!
Financial Statements

Revenue and Expenses

STOMP’s expenditures for Fiscal Year 2017, July 1, 2016 through June 30, 2017, totaled $134,438.49. Expenditures increased this year as STOMP continues to employ a graduate student whose research focuses on STOMP’s impact, and hired more undergraduates. Support comes from generous donations, the Tides Foundation grant, and the Tufts School of Engineering Dean’s Office, which supports the STOMP manager position.

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Fundraising

In fundraising results for fiscal year 2017, generous friends and alumni made gifts and pledges to STOMP totaling $70,270. STOMP also drew funds from the Tides Foundation. This support will maintain STOMP’s excellence, and is providing operating funds, seed funding for new initiatives, and funding to extend STOMP’s outreach in the community.

Join us by visiting Tufts University’s secure donation site at go.tufts.edu/STOMPdonate.

Overall FY 2017 Revenue
Total: $105,270.00

Overall FY 2017 Expenses
Total: $134,438.49

Help us reach our fundraising goals!
go.tufts.edu/STOMPdonate