Annual Report
2015-2016

Student Teacher Outreach Mentorship Program

Tufts University Center for Engineering Education and Outreach
STOMP Manager’s Executive Summary

The following is a report to document the Fiscal Year (FY) July 1, 2015-June 30, 2016 efforts of the Tufts University Center for Engineering Education and Outreach's (CEEO) Student Teacher Outreach Mentorship Program (STOMP). Provided in this report is an overview of the program, what happened this school year, changes from previous years, and planned changes for the future.

With another changing of the guard, STOMP experienced an incredible year of growth while continuing with the improvements my predecessor, Jess Scolnic, made. The thirty-three percent increase in outreach required the executive board to take on more responsibility as each member held a position with a slew of responsibilities attached, including running their own meetings, events, and workshops. The focus this year was on providing more resources and professional development to ease the learning curve for new fellows, which manifested in having a mentor, and a STOMP Squad (group of 4 Fellow pairs that meet weekly) to serve as a more intimate community within the program at large. I also strove to partner with more Tufts departments and outside organizations to further extend our outreach and connect with like-minded groups.

In the year ahead, I look forward to fostering more connections as the executive board directs more focus toward community outreach. I am excited to scale the scheduling system, as we are projected to reach forty-five classrooms with fifty-five fellows this fall. With the increase in classrooms, executive board Squad leaders will be taking on more of a management roll, keeping tabs on their assigned classrooms, collecting deliverables, and then observing and providing feedback to their fellows.

As STOMP continues to grow, your contributions to the program are as vital as ever, and we sincerely appreciate your continued support!

All the best,
Devyn Curley
STOMP Manager
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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.
Checking in with STOMP Alumni

Joseph Weidenbach, Class of 2007

I graduated from Tufts in 2007 with a bachelor’s degree in mechanical engineering. Following graduation, I moved home to Hawaii and quickly realized that many of the exciting career opportunities here were in civil and environmental engineering fields due to the rapid pace of development for the housing and tourism industries in Hawaii. I made the decision to pivot careers, and am now working as an environmental consultant at Weston Solutions, Inc. While Weston does a variety of environmental work, I focus on supporting the Department of Defense in their mission to clean up historical unexploded ordnance sites from World War II.

I was fortunate to work for a company that also believed in community outreach, and was able to be part of our “Making a Difference” committee. As part of this group, we were able to work with elementary schools within the neighboring communities of our projects to improve the schools in a way that benefited the environment and at the same time taught students about scientific and engineering principles. In one school, we taught students about the water cycle and the effect of runoff on our essential soils, while replacing impermeable concrete with permeable pavers around the school to reduce runoff. At another school, we worked with students and teachers to design and build a stage for the school’s hula performances. I’m thankful to continue to have the chance to get students excited and interested in STEM even after leaving Tufts.

There is no question that I look back at my experience as a STOMP fellow as one of my favorite memories of Tufts. Being put in a classroom with fourth and fifth graders forced me to cut away the often confusing engineering-speak and explain concepts in a way that is both accessible and interesting in order to give them the confidence and understanding they needed. That skill is something I continue to try to improve in my career, as it is necessary on a daily basis to communicate with people from different backgrounds, with different areas of expertise, and different learning styles in order to collaborate on any project. I hope to work in industry for a while longer, then to eventually go into education. There is something very rewarding in being part of that process—which is something I learned from my time at STOMP!
STOMP had another record-breaking year, with sixty-five fellows working for the program. These fellows worked in forty classrooms, impacting approximately 820 K-8 students, the largest number in STOMP history!

The general makeup of the fellows maintained a two to one ratio of females to males, which is highly unusual in a group comprised of mostly engineering students. Of the forty-two female STOMP fellows, twenty-five are engineering students. Therefore, 38 percent of STOMP fellows are female engineering students. This is a greater percentage than the total female population in the School of Engineering. The thirty-eight undergraduate engineering students in STOMP make up 3 percent of the total undergraduate engineering enrollment. The twenty-five undergraduate female engineers make up 8.5 percent of the total female undergraduate engineering enrollment.

<table>
<thead>
<tr>
<th>Fellow Class Distribution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of freshmen</td>
<td>23</td>
</tr>
<tr>
<td>Number of sophomores</td>
<td>12</td>
</tr>
<tr>
<td>Number of juniors</td>
<td>12</td>
</tr>
<tr>
<td>Number of seniors</td>
<td>15</td>
</tr>
<tr>
<td>Number of graduate students</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fellow Gender Distribution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of female fellows</td>
<td>42</td>
</tr>
<tr>
<td>Number of male fellows</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fellow School Distribution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fellows in Arts and Sciences</td>
<td>20</td>
</tr>
<tr>
<td>Number of fellows in Engineering</td>
<td>38</td>
</tr>
<tr>
<td>Number of fellows undecided</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 3: STOMP fellow statistics
STOMP Statistics

Mechanical engineering is the most common major amongst fellows (17 percent of fellows). Other represented engineering majors include computer science, environmental engineering, chemical engineering, electrical engineering, civil engineering, human factors engineering, and biomedical engineering. Fellows in non-engineering majors make up 31 percent of STOMP; these majors include child study and human development, mathematics, biology, chemistry, economics, and cognitive brain science.

The thirty-nine participating classrooms this year were spread across eight local communities and fifteen locations. As in previous years, fifth grade was the most represented grade in STOMP, but we served students in grades three through seven.

<table>
<thead>
<tr>
<th>City/Town</th>
<th>Participating Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington</td>
<td>M. Norcross Stratton Elementary School</td>
</tr>
<tr>
<td>Boston</td>
<td>Josiah Quincy Elementary School, F. Lyman Winship Elementary School, Maurice J. Tobin K-8 School</td>
</tr>
<tr>
<td>Cambridge</td>
<td>International School of Boston</td>
</tr>
<tr>
<td>Everett</td>
<td>Albert N. Parlin School</td>
</tr>
<tr>
<td>Malden</td>
<td>Linden STEAM Academy</td>
</tr>
<tr>
<td>Medford</td>
<td>Saint Joseph School, Columbus Elementary School, Brooks Elementary School</td>
</tr>
<tr>
<td>Somerville</td>
<td>Arthur D. Healey School, Albert F. Argenziano School, West Somerville Neighborhood School</td>
</tr>
<tr>
<td>Winchester</td>
<td>Vinson-Owen Elementary School, Acera</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of Participating Classrooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third</td>
<td>3</td>
</tr>
<tr>
<td>Fourth</td>
<td>14</td>
</tr>
<tr>
<td>Fifth</td>
<td>16</td>
</tr>
<tr>
<td>Sixth</td>
<td>5</td>
</tr>
<tr>
<td>Seventh</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 4: STOMP classroom statistics

A main goal of STOMP is to provide services to a diverse group of students in the communities most immediate to Tufts: Medford, Somerville, and Boston. In 2015–2016, nine schools out of the participating fifteen were in these areas. Below is a table describing the ethnic distribution in percentages for these schools during the 2015—2016 school year:
Tufts STOMP

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Asian</th>
<th>Hispanic</th>
<th>White</th>
<th>Native American</th>
<th>Multi-Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>22.3</td>
<td>22.9</td>
<td>37.3</td>
<td>12.5</td>
<td>0.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Medford</td>
<td>14.7</td>
<td>5.3</td>
<td>8.2</td>
<td>67.2</td>
<td>0.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Somerville</td>
<td>11.0</td>
<td>7.1</td>
<td>36.7</td>
<td>41.5</td>
<td>0</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Figure 5: Average ethnic distribution (by percentage) for STOMP supported schools in core Tufts communities

STOMP strives to reach high-needs students in the core Tufts communities of Medford, Somerville, and Boston. Below is a table describing the percentage of students in these communities that are included in the Massachusetts Department of Elementary and Secondary Education report on “Selected Populations.”

<table>
<thead>
<tr>
<th>City</th>
<th>First Language Not English</th>
<th>English Language Learner</th>
<th>Students with Disabilities</th>
<th>High-Needs Students</th>
<th>Economically Disadvantaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>52.2</td>
<td>42.4</td>
<td>15.6</td>
<td>81.1</td>
<td>57.7</td>
</tr>
<tr>
<td>Medford</td>
<td>22.0</td>
<td>9.2</td>
<td>13.3</td>
<td>38.3</td>
<td>24.0</td>
</tr>
<tr>
<td>Somerville</td>
<td>42.2</td>
<td>54.7</td>
<td>19.9</td>
<td>59.1</td>
<td>39.3</td>
</tr>
</tbody>
</table>

Figure 6: Data on average percent of selected populations for STOMP-supported schools in core Tufts communities

For more information on how these metrics are tabulated, please see: [http://profiles.doe.mass.edu/help/data.aspx?section=students#selectedpop](http://profiles.doe.mass.edu/help/data.aspx?section=students#selectedpop)

For a by-school breakdown of the above data, please see Appendix A.

**Efficient Scheduling System**

This past year, STOMP was able to support forty-one classrooms as the program experienced over a thirty percent growth from the previous year. This increase in outreach was done at very little financial cost as only three more fellow positions were required. This efficiency was due to a new method in scheduling classrooms. Previously the standard was for two or three fellows to teach in one classroom each semester. Occasionally due to scheduling logistics, one pair of fellows would teach two classrooms in the same grade in the same school. Initially viewed as a burden, this situation gave the participating STOMPers a very developmental experience. The second lesson of the two in a row that they taught proved to be much for efficient and effective than the first, having learned what worked and what did not work in the previous class. During this past spring that situation was pushed toward the standard, as teachers were asked to coordinate with peers in their school to schedule their classrooms back-to-back for one pair of fellows. This cuts major expenses for the program in training and travel time without negatively impacting our outreach. Teaching two classrooms has provided our fellows with more practice and more personal impact, and our teachers and students received a greater quality curriculum and experience overall.
Meeting Schedule: Fall 2015

In the fall semester, the weekly meetings focused on exposing STOMP fellows to new ideas in engineering education. This semester used a variety of different meeting styles including guest lectures, squad meetings, PechaKucha talks (presentations without any on screen text, only pictures), and an improv meeting. Executive board members and experienced STOMPers were encouraged to share their knowledge.

Fall Semester 2015

9/16/15 We welcomed returning STOMP fellows back with a rousing game of STOMP Trivia and a presentation and pitch for the new Mentor Program (see page 19).

9/23/15 At the first all-STOMP meeting, new STOMP Squads were revealed (see page 22), and returning fellows shared curriculum ideas with their squads.

9/30/15 STOMP fellows met at the CEEO at 200 Boston Ave. for a tour of the center and an introduction to its amazing resources.

10/7/15 STOMPers presented on their current curricula and worked together to troubleshoot and improve their respective plans.

10/14/15 We conducted our bi-annual Knowledge Cafe, created by previous manager Jessica Scolnic. At this meeting, STOMPers rotated through small groups to constructively brainstorm ways to improve the program.

10/21/15 This improvisation-based meeting was focused on providing an opportunity for fellows to practice problem solving on their feet, which is a useful skill for handling the unexpected in a classroom.

10/28/15 Executive board member Alison Borieko ran this meeting, giving a presentation and running a number of activities related to Project Based Learning.

11/4/15 The Chair of the Physics Department, Roger Tobin, presented on his work in Science and Math education.

11/18/15 Steve Cohen, a Senior Lecturer in the Education Department, discussed his perspective on STEM Education and the impact STOMP can have.

12/2/15 The tradition of fellows sharing interesting and related work to their peers through engaging five-minute PechaKucha presentations.

12/19/15 We finished off the semester with our traditional pizza party where fellows filled out end-of-the-year surveys to provide their feedback.
Tufts STOMP

Meeting Schedule: Spring 2016

This STOMP spring semester started late due to our late return date, but the fairly mild winter allowed Wednesday meetings and classroom sessions to go on as planned. Meetings continued to be productive time for STOMPers to share their experiences and work on their curricula.

Spring Semester 2016

1/27/16  In this first meeting of the semester we had an overview of semester changes, held group discussions of why we do STOMP, and what we learned last semester.

2/3/16  With new fellows joining our community for the first time, the emphasis on this meeting was to welcome new fellows, review new fellow resources, and introduce everyone to their STOMP Squad.

2/10/16  Dan Callahan lead a review of the website, and Karen Miel introduced a new activity sheet for fellows to critically review STOMP lessons.

2/17/16  Barbara Bratzel showed a video on right and wrong ways to lead a class discussion, and STOMPers were exposed to coding in Scratch, a useful visual programming language and resource for teaching programming.

2/24/16  CEEO Director of Outreach Elissa Milto lead a professional development meeting, and STOMPers all wore their STOMP shirts.

3/2/16  STOMPer pairs shared their curriculum in squads, troubleshooting unexpected problems that arose.

3/9/16  STOMP improvisation meeting.

3/16/16  Kristen Wendell, CEEO alumna and professor in Mechanical Engineering, walked STOMPers through student thinking with her research videos.

3/30/16  STOMPers changed their setting and met in Sophia Gordon Hall for an hour of hands-on practice with some STOMP activity staples (Squishy Circuits, Snap Circuits, LEGO Mindstorms NXT, and Scratch Programming).

4/13/16  STOMP fellows engaged in the increasingly familiar Knowledge Cafe, but instead of physically changing tables, STOMPers navigated the discussion topics virtually using a forum in Visual Classrooms.

4/20/16  Within STOMP Squads, fellows created lesson introductions with SAM Animation.

4/27/16  The last meeting of the semester was spent eating pizza, filling out exit surveys, and thanking seniors. (We're going to miss them!)
In the Classroom

This year, STOMP fellows focused on creating innovative curricula to engage their students throughout the semester. Some creative units designed by STOMP fellows include:

- **Music Engineering** taught by Emma Coltoff and Ross Kamen
- **Building the City of the Future** taught by Mile Krstev and Thomas DePalma
- **Simple Machines and Disability Engineering** taught by Orian Sneor and Rati Srinivasan
- **Superhero Sidekicks: An Introduction to Engineering** taught by Laura Fradin and Jill Gerke

Below is the outline of Laura Fradin’s curriculum unit called “**Superhero Sidekicks: An Introduction to Engineering**.” Each week, fifth-grade students were introduced to a new superhero that had a problem that his or her engineering sidekick (the students) had to solve using specific engineering concepts. This unit served as a fun and engaging way to introduce students to a variety of different types of engineering.

<table>
<thead>
<tr>
<th>Activity Number</th>
<th>Lesson</th>
</tr>
</thead>
</table>
| 1               | **Design a Superhero Logo: Introduction to STOMP**  
This activity served as an introduction to STOMP and the engineering design process. Students designed their own superhero logo and then had to modify their designs based on different requirements/constraints (the logo must look 3D or they can only use the blue marker). This mimicked the engineering design process (EDP) as students had to make different iterations of their initial design.  
**Engineering Skill:** Students learned about the engineering design process. |
| 2               | **Captain America: Introduction to Aeronautical Engineering**  
Students watched the plane crash scene from *The First Avenger* and were then tasked with saving Captain America. The students built parachutes and tested them in a wind tunnel. Students were introduced to the concepts of aerodynamics, air resistance, and surface area.  
**Engineering Skill:** Students learned about aerodynamic design. |
| 3               | **Hawkeye/Green Arrow: Introduction to Aeronautical Engineering**  
Students continued to learn about aerodynamics by helping Hawkeye and the Green Arrow, both of which use their archery skills to defeat enemies. The two archery heroes tasked the students with building them some new trick arrowheads that could turn in mid-air, fly the greatest distance, and fly the most accurately. Students built paper planes as model arrowheads and tested them.  
**Engineering Skill:** Students learned about the forces that act upon an airplane (drag, lift, thrust, gravity). |
| 4               | **Green Lantern: Introduction to Electrical Engineering**  
Students were tasked with fixing the Green Lantern’s ring by building a new circuit for him. The students first learned the basics of circuits by “acting out” electricity. Students pretended to be electrons, switches, resistors, and batteries, and moved about the circuit. The students then built their own circuits using Snap Circuit kits.  
**Engineering Skill:** Students learned about circuits. |
|   | **Ironman and Jarvis: Introduction to Computer Programming**
|---|---
|   | Students were introduced to Ironman’s complex computer program JARVIS. Unfortunately, Jarvis had a bug and the students needed to reprogram him. Using the Human Robot activity, students practiced giving specific instructions that a robot would be able to understand. Students programmed their STOMP instructor (the LauraBot) to get from one side of the room to the other by walking, jumping, climbing, crawling, and somersaulting across the room.
|   | **Engineering Skill:** Students thought critically about how to communicate with robots.

|   | **Wonder Woman: Introduction to Simple Robotics**
|---|---
|   | Students continued with the idea of programming by working with LEGO Mindstorms NXT robotics. Students were tasked with building a prototype of an invisible car (much more practical for local crises than the invisible plane) for Wonder Woman. The students built their robots and used on-brick programming to get them to move.
|   | **Engineering Skill:** Students were introduced to LEGO Mindstorms NXT robotics and on-brick programming.

|   | **Baymax: Introduction to Biomedical Engineering**
|---|---
|   | Baymax (from *Big Hero 6*) is a great diagnostic tool, but doesn’t have the technology to provide solutions for all of his patients. He asked the students to find a solution for his most recent patients, a litter of puppies that were born without functioning back legs. Students designed and built prosthetics and dog wheelchairs to help the pups get around.
|   | **Engineering Skill:** Students learned about biomedical engineering and prosthetics.

|   | **Spiderman: Introduction to Chemical Engineering**
|---|---
|   | Spiderman created his own bio-cable that he uses to swing from building to building. Too busy saving the streets of New York, he tasked the students with testing a new formula for it. The students made Flubber and discussed whether or not it would be a good material for Spiderman to use.
|   | **Engineering Skill:** Students learned about atoms, elements, and chemical reactions.

|   | **Avengers: Introduction to Civil Engineering**
|---|---
|   | The Avengers are a team of superheroes tasked with saving the world. However, in many of their battles, they end up destroying the buildings and bridges around them. Students were asked to serve as civil engineers for the Avengers and build Avengers-proof buildings out of the materials we provided. Their buildings were tested with a drop test and by being hit with Thor’s hammer.
|   | **Engineering Skill:** Students learned about the role of civil engineers and the effects of using different materials when building.

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**Figure 7: A Superhero-themed STOMP logo**
Publicity: STOMP T-Shirt

For the eighth year in a row, T-shirts were made for all of the fellows to both advertise the program to the Tufts student body and to thank the fellows for their hard work. Throughout the year, STOMP held T-shirt days on Wednesdays to raise awareness about STOMP through visibility. The T-shirts often prompted many questions of “What is STOMP?”, setting up STOMPers to share their passion and excitement for the program and STEM education with the Tufts community.

Former STOMP manager Jessica Scolnic created the design. In this photo, the shirt is modeled by STOMPper Laura Fradin.

Publicity: Recruitment

In the third year of the publicity head position on the STOMP executive board, we have enjoyed an increasing presence on campus, and it has had a very positive impact on our application process. In addition to that, more STOMP Fellows are sticking with the program from semester to semester as a result of their positive experience working for the program. The combination of these two changes resulted in a historically low acceptance rate (25 percent) this past spring after accepting participants from the shadow program. This percentage would have been even lower if we had not added ten classrooms from the semester before in response to the overwhelming interest. While it proved to be incredibly difficult to reject so many great applicants, this percentage has raised the bar for all STOMP fellows in terms of enthusiasm, work ethic, and preparedness in the classroom.

In order to recruit the best teachers, STOMP runs a few tabling events at which they publicize the program in a highly trafficked area of campus and give out STOMP job applications. This year, the STOMP recruitment table used a new tactic called StickTogether to attract potential applicants. Participants ‘StickTogether’ by adding colored stickers to a large color-coded grid. When all of the stickers are attached, a mosaic-like image is revealed. As students came over to add a sticker or two to the collaborative image, STOMPers had the opportunity to “pitch” STOMP to them.
Publicity: Events

Outside of recruitment, STOMP also participated in publicity events with the greater Tufts community. Tabling at these events has helped not only gain more publicity with students, but also gauge interest and gain support from parents, professors, Deans, and other members of the Tufts community.

Halloween on the Hill: This is an annual event run by Tufts undergraduates during which young children dress up and travel around campus, stopping at various stations and eating candy all along the way! Staying with the candy theme of Halloween, children built vehicles out of LEGO Mindstorms NXT robots that could push candy around the table and into their trick-or-treat bags.

Kids Day: This event is a Tufts staple as it has been occurring annually for more than fifty years. Local children go around campus and participate in various activities hosted by Tufts undergraduates. The STOMP table led a Squishy Circuits activity and was a popular attraction throughout the event. Children built circuits and experimented with building different combinations of parallel and series circuits.

Watertown Science Night: This event was hosted by the James Russell Lowell School and invited pre-K through fifth-grade students to come explore different science projects. STOMP set up a table and led a Squishy Circuits activity. It was great to watch the kids come to an understanding, and go from having no idea how electricity works to being able to build a pretty complex and functional circuit within about five minutes. Overall, the activity was a huge success and we were one of the busiest tables at the event!
Financial Statements

STOMP’s expenditures for Fiscal Year 2016, July 1, 2015 - June 30, 2016, totaled $104,152.70. Expenditures increased this year as STOMP now employs a graduate student whose research focuses on STOMP’s impact. Support comes from a faculty NSF Career Grant (“Probabilistic Nonlinear Structural Identification for Health Monitoring of Civil Structures , PI Babak Moaveni, Civil and Environmental Engineering) and the Tufts School of Engineering Dean’s Office, which supports the STOMP manager position.

STOMP continues to be supported by carry-over from the LLL Foundation gift challenge and other previous grants and gifts. STOMP received a $5,000 donation from the Move the World Foundation. This year saw a decrease in donations.
What Happened in 2015-2016

**STOMP Funding**

In fundraising results for fiscal year 2016, generous friends and alumni made gifts and pledges to STOMP totaling $5,000. Thanks to these donations there is over $126,000 in the STOMP account. This support will maintain STOMP's excellence, and is providing operating funds, seed funding for new initiatives, and $120,000 for a STOMP challenge campaign which began in the spring.

Help us reach our goal, *your donations will be matched dollar-for-dollar.* Make your mark on STOMP and give today.

Join us by visiting Tufts University's secure donation site at tinyurl.com/STOMP-Donation.

![Pie chart showing revenue breakdown]
Mentorship and Shadow Programs: Bettering the STOMP Fellows of Tomorrow

Mentorship Program

As mentioned in last year’s report, STOMP implemented two programs to help new STOMPers transition into the classroom. The mentorship program was intended to provide additional mentorship, guidance, and advice for those newly hired to STOMP. The shadow program was piloted as a recruitment tool and a means to acclimate fellows to the program before being hired. Both programs sought to improve the quality of STOMP fellows.

When we launched the mentorship program in the fall, there was a lot of interest from current STOMP fellows who wanted to be mentors for the incoming fellows. Mentor responsibilities included communicating with your mentee once a week, completing sorting of LEGO Mindstorms kits with them, assisting with curriculum development, and attending mentor/mentee trainings and retreats. While mentors and mentees did enjoy getting to know each other, we eventually realized that the program wasn’t needed. As STOMP fellow acceptance rates have gone down, the new fellows have been better qualified for the program. There were some students who were mentees that actually had more teaching and curriculum development experience than their mentors. For this reason, we decided to not continue the program and instead have tasked STOMP Squad Leaders and STOMP Partners to help new fellows.

Figure 12: STOMP partners Jill Gerke and Laura Fradin dressed up for Halloween with their STOMP classroom and planned a Halloween-appropriate chemical engineering lesson. Using borax, glue, and water, the students made Flubber.
Shadow Program
Applying to STOMP became incredibly competitive this year, with thirty-seven students applying for seven fellow positions. This provided an incredibly qualified and selective pool of candidates. In conjunction with efforts to provide fellows with more resources their first semester, the Shadow Program was created to keep more applicants involved in STOMP on a volunteer basis. These Shadowers were assigned to STOMP Squads, invited to Wednesday's meetings and workshops, and also required to observe at least one classroom. All of these elements come together to give Shadowers a deeper understanding of the program, and a semester of experience under their belt to strengthen their application for the following semester. During the fall we had four Shadowers, three of whom we hired for the spring, where they proved to be very strong fellows. The program expanded to eight Shadowers this spring, and we’re very excited to have six of them returning to us as fellows!

Looking forward, we are looking for different ways to fund Shadowers in order to make the opportunity more financially acceptable. In addition to Wednesday meetings and classroom observations, Shadowers will be paid to run workshops at the CEEO alongside an experienced education specialist. In addition to a source of funding, this allows participants in the program to experience our brand of teaching first hand.
Professional Development for STOMPers

Throughout the semester, STOMP fellows participate in workshops to improve their own engineering and teaching skills for use in the classroom. This year STOMP held workshops about classroom management, robotics, curriculum development, and the use of competition in the classroom. These workshops were run by CEEO staff members or experienced STOMP fellows.

**Classroom Management:** Executive board members Alex Pugnali and Eleanor Richard ran a workshop devoted to classroom management and observation. Classroom management is one of the topics that fellows report having the most trouble with, and the ability to take control of a classroom can drastically alter what students get out of their STOMP experience. This workshop was held before STOMP fellows entered their classrooms for the first time, so the workshop taught fellows about the importance of observing the students, teacher, and classroom. The goal was to give fellows some tools that they could use to help manage their classroom, while also teaching them the importance of keeping classroom norms and trying to replicate their classroom teacher’s management style.

**Robotics:** Senior mechanical engineer and STOMP executive board member Daniela Torres led this workshop. The Robotics workshop has been a staple of STOMP training for years. It serves as an introduction to robotics for our new fellows, and as an opportunity to refine skills for experiences fellows. Although it is impossible to master LEGO Robotics in two hours, this workshop provides the basic tools for fellows to build upon and practice on their own.

**Curriculum Development:** Katherine McMurray, Head of Curriculum Development, led this workshop in both the fall and the spring. Curriculum development is an important aspect of the STOMP classroom because it is the framework upon which all lessons are built. This workshop gave partners a creative environment to innovate and brainstorm ideas with one another and with other fellows. Katherine detailed the different components of a strong, successful curriculum, and the importance of creating an overarching theme to connect each lesson to a common learning goal.

**Competition in the Classroom:** Executive board members Sam Slate and Eva Philips ran this workshop that analyzed the use of competition in the classroom. Competition can be a great tool, but can also be overused or improperly used. Through anecdotal evidence, discussion, and brainstorming, fellows used this workshop as an opportunity to gain a deeper understanding of how they can best incorporate competition in their classroom.
What Happened in 2015-2016

STOMP fellows convene each Wednesday for a meeting. These meetings provide the opportunity for STOMP fellows to learn from guest lectures, share their own experiences, and learn important information that may help them in their classrooms. This year, we continued with some of the new meeting formats (PechaKucha talks and an improvisation meeting) that were launched last year, and also introduced some new formats.

Executive Board Leadership: This year, we implemented a few new methods for Wednesday meetings. Executive board member Alison Boreiko led a discussion and meeting about project-based learning. In this meeting, students were read a series of statements and had to line up based on how much they agreed or disagreed with that statement. The statements were about types of learners, different teaching styles, and project-based learning. This led to an in-depth discussion about their own learning experiences and preferences.

STOMP Squads: Mini-groups have proven to be very helpful in the recent history of STOMP. They serve as a time for fellows to come together and share what is going on in their classrooms, and bounce ideas around to troubleshoot current hurdles. As beneficial as these sessions proved to be, STOMPers gave feedback that they felt STOMP was missing a sense of community that they experience in more socially engaging clubs on campus. This year, the executive board set out to change that with a simple mindset shift. By taking everything that was effective about mini-groups and putting them in the context of a social and supportive community, STOMP Squads were born. In order to get fellows excited about their squads, a large reveal was held on the first all-STOMP meeting. Each executive board member led a squad, and took ownership of connecting their group on social media and organizing bonding activities outside of meeting time to help facilitate that sense of community. In the past, STOMPers have lamented that they don't know other fellows in the program well besides their partners, so squads have served as a start to changing that. A stronger community leads to a stronger program!

Hands-On Activities: One Wednesday meeting provided a change of scenery as STOMPers met in the multipurpose room of Sophia Gordon Hall. At this meeting, STOMPers moved between stations to get some hands-on experience with Squishy Circuits, Snap Circuits, Scratch Animation, and LEGO Mindstorm NXT Robotics.
Executive Board Roles

Tufts STOMP currently employs sixty-five graduate and undergraduate students. To help manage the increase in participants and the subsequent increase in program management workload, the executive board members take on different roles.

**Web Masters:** Dan Callahan and Ali Boreiko handled our fantastic website, sites.tufts.edu/stomp. This website serves the program internally, while also providing information and resources to parents, teachers, and students who want to learn more. For our fellows, the website holds many of our training resources, and is the destination for curricula submissions. These curricula are then edited by our Web Masters, and put into our database that is shared with the public as a resource for anyone interested in teaching or completing hands-on STEM activities.

**Publicity:** Eva Philips joined Daniela Torres, the publicity head from last year. They worked hard to continue the momentum from previous years and their effort was rewarded with a record low acceptance rate in the spring. The many promotional events that STOMP put on struck a balance between benefitting the community, providing hands-on STEM challenges, and putting the STOMP name out into the community, letting students and visitors alike know how great our program is! See pages 15–17 for more information about STOMP publicity.

**Mentorship Program:** Alex Pugnali created the mentorship program in the fall and was joined by Caitlin Duffy in the spring. They strove to receive and act on feedback from the fall, and make the mentor program a community in itself for new fellows who want to learn, and mentors who want to share from their experiences. To learn more about the Mentorship Program, see page 19.

**Shadow Program:** Eleanor Richard started her executive board career as STOMP’s Logistics Coordinator, but quickly latched on to the idea of the Shadow Program, putting a great deal of time and effort into running the program by herself. While the applicants accepted into the Shadow Program are decided on by the executive board and manager, Eleanor acted as the point person for the group, answering any and all questions the Shadowers had. She used her strong propensity for compassion to ensure that the Shadowers felt included in the program, and that they had an informative experience. She handled all of their exit interviews, making hiring recommendations, and putting together an outline of responsibilities for whoever takes on the position this upcoming year. To learn more about the Shadow Program, see page 19.
2015–2016 Changes

The following changes, described in last year’s annual report, were successfully initiated:

- Implementing the STOMP Mentorship Program
- Piloting the STOMP Shadow Program
- Creating and implementing the use of pre-made kits for Squishy Circuits and Aluminum Foil Boats, as well as the use of Mini LEGO Robotics Kits

Many of these ideas will continue to grow and develop in the coming year.

Figure 14: Fall 2015 STOMP Fellows
Areas of Focus for 2016–2017

The following areas will be a focus for change during the 2016–2017 academic year. These changes may take more than one year to complete and may require multiple iterations.

- 3:4 classroom to fellow ratio (compared to 1:2 in 2014)
- Increased training at the start of the year
- Heightened expectations for STOMP fellows
- Improved resources for STOMP fellows

Additionally, many initiatives that began last year will be continued. Improving STOMP fellow resources is still a high priority and resources such as and improved STOMP activity database and a STOMP App will be created. The STOMP reputation is expected to only increase around campus, as more publicity events will be held. STOMP research is also beginning to ramp up to full speed as a PhD candidate will be focusing their dissertation on measuring the impact of the program.

Figure 15: Fifth graders at Brooks Elementary School designed and built bridges in a civil engineering unit
Improving STOMPer Training and Expectations

Improved Training
This upcoming fall 2016, STOMP will host its first ever day-long training retreat for both new and returning STOMP fellows. The training will include the following topics:

- Child development across 1st–8th grade students
- Introduction to teaching
- Classroom management and observation
- Writing a curriculum and Common Core standards
- Using educational technology tools
- Systems of power in education

Additional trainings will be led by STOMP executive board members and guest speakers throughout the year

Increased Expectations
More explicit expectations for STOMP fellows (completing a unit and submitting it in full at the end of the semester, uploading new COMPLETE activities to the database or commenting on old activities), coming to all trainings, maintaining contact with teachers and partners:

- Fellows will have to sign an official contract outlining what their responsibilities are in the program
- Fellows will also create a contract with their STOMP partner outlining their expectations for each other
- At the end of each semester, fellows will be reviewed to see if they are meeting the expectations

More explicit expectations will also be outlined for members of the STOMP executive board:

- Executive board members will also sign an official contract outlining what their responsibilities are in the program
Improving STOMPer Resources

Updated Activity Database:
The STOMP activity database has been a useful resource for STOMP fellows. This summer, the activities were compiled and rewritten to include more information and better instructions. For more details on the revamped activity database, see page 28.

STOMP App:
A major problem that STOMPers face is lack of transparency with materials. This includes not knowing which materials are in the STOMP closet, how many will be there when their classroom meets, who has the materials in case they need to contact someone. This app attempts to solve this. STOMPers will use this app to check out, return, and reorder materials they use in the classroom. The core part of the functionality is an application programming interface (API) that connects to a database. The app then makes calls to the API to complete actions and the database is updated. This will be integrated into the website so that STOMPers can check the availability of materials without having to go all the way to the CEEO, also alerting Fellows if they need to order materials.

STOMP Booklet:
The STOMP booklet is a resource made to be a part of the STOMP “pitch.” It is intended to be something that potential donors and teachers can read to gain an understanding for the STOMP fellows and the curricula they teach. The STOMP booklet introduces some STOMP fellows and details why they chose to participate in STOMP and what they gain from the experience. The curriculum section of the booklet showcases some curricula that were taught in the classrooms during spring 2016 and includes anecdotes and pictures from the semester.

STOMP Calendar:
STOMP training and workshops are an important aspect of the professional development of our STOMP fellows. Unfortunately, the schedule for these trainings is not always available at the beginning of the semester, making it easy for STOMPers to miss a workshop. To combat this, STOMP plans to release a calendar at the beginning of the semester so that fellows have enough notice to plan around them. This will ensure high rates of attendance at all professional development workshops.
Updated STOMP Activity Database

The STOMP activity database is a useful resource for STOMP fellows to use when searching for ideas for lesson plans and semester-long curricula. It can also be a useful tool for teachers who do not have access to STOMP. However, having not been updated for many years, the database was full of duplicate activities as well as lesson plans that lacked the detail to be useful. To remedy this, the activity database has now been “cleaned up” so that similar activities have been compiled into single, well-written, and complete lessons. Activities that previously had little content or instructions now contain information about the science and engineering related to the activity as well as detailed instructions of how to complete the activity. This makes the activity database easier to use and more accessible for teachers.

The STOMP activity database will now have two separate levels; one meant for STOMP fellows and the other meant for the public.

1. Public site
   - The public site will contain activities that are classroom tested and STOMPer approved. These lessons and units are completely fleshed out, containing all information about the scientific concepts, instructions for the activity, discussion questions, and photos of projects.
   - The public site is meant to serve as a resource for both STOMP fellows and classroom teachers who do not have access to STOMP

2. STOMP fellow site
   - The STOMP fellow site includes activities or units that are slightly less fleshed out. This includes LEGO Mindstorms NXT robotics challenges, past units, and new activities that have yet to be tested in a classroom.
   - The fellow site will also contain a comments section where STOMP fellows can voice their concerns and struggles without making them public knowledge. Because the comments section is now for STOMP eyes only, fellows no longer have to worry about detailing the problems they face in their classrooms.

STOMPers will now upload units to the STOMP fellow site. If STOMPers write an activity that was previously not on the database, it will be uploaded to the fellows site, and only uploaded to the public site if the write-up is deemed complete.
STOMP Research

This spring, we focused our research on the benefits of STOMP for elementary students. In particular, we focused on the interactions between STOMP students and STOMP fellows and began describing the nature of those interactions. By looking at these classroom exchanges, we hope to shed light on what makes STOMP an effective model of elementary engineering education.

In addition, we interviewed several teachers, STOMP fellows, and students about their experiences with STOMP. Participating teachers and STOMP fellows pointed to the idea that STOMP fellows provided positive role models for students, and we’re planning future studies to dig into this idea and elucidate how students identify and select engineering role models.

Students saw STOMP as an exciting part of their school day, and often mentioned that they liked the hands-on, “making” nature of STOMP. These students described STOMP as a time during which they felt especially successful in school. While some students mentioned the hands-on nature of STOMP engineering activities as what made them feel successful, others mentioned caring interactions with STOMP fellows as important to them. In interviews, several STOMP fellows specifically mentioned that they work to ensure that all students feel respected, cared for, and included in the STOMP classrooms.
Appendices

The following tables are comprised of average data for participating STOMP schools in the Tufts core communities. The data comes from the Massachusetts Department of Education State Enrollment Reports from the 2015–2016 school year.

### Ethnic Distribution Data Percentages for STOMP-Supported Schools in Core Tufts Communities by School

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<th>City</th>
<th>School</th>
<th>African American</th>
<th>Asian</th>
<th>Hispanic</th>
<th>White</th>
<th>Native American</th>
<th>Multi-Race, Non-Hispanic</th>
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### High Needs Data Percentages for STOMP-Supported Schools in Core Tufts Communities by School

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<th>Students with Disabilities</th>
<th>High Needs</th>
<th>Economically Disadvantaged</th>
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