Manager’s Executive Summary

The following is a report to document the 2014-2015 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.

2014-2015 was an exciting year as the CEEO settled into its new home at 200 Boston Avenue. New and innovative spaces for STOMP fellows to work brought 3D printing to classrooms, and STOMP forged new international partnerships. Many of the goals set last year have been accomplished: STOMP resources have been improved, the Executive board has taken on new roles, and we have a plan to jump-start new research on STOMP. At meetings this year, experienced STOMP fellows had the chance to share their knowledge through “2-Minute Talks” that really inspired their peers.

We also have some great new innovation coming up in the 2015-2016 year, including brand new kits for STOMP classrooms, new leadership positions, and a totally revamped “New STOMP Fellow Experience.” This experience will be headlined by a creative new mentorship program.

Lastly, I’d like to introduce the next program manager, Devyn Curley. Devyn has just finished his BS in Mechanical Engineering and will be continuing at Tufts to pursue an MS. I know Devyn will do an incredible job helping STOMP grow over the next two years, and I cannot wait to see what he accomplishes.

Thank you for your continued support of STOMP!

Jessica Scolnic
2014-2015 Program Manager

Devyn Curley
2015-2016 Program Manager
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The STOMP Model

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 gift from the LLL Foundation for three years. 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 paired with more experienced fellows. Together, fellows work with a classroom teacher to create a 10-week curriculum, implemented in once-a-week, hour-long visits to a local classroom. Fellows are trained in working in a classroom and implementing engineering design-based lessons through their more experienced partner and through weekly meetings. 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.
Tufts STOMP

STOMP Management

Chris Rogers  
Co-Director of CEEO

David Hammer  
Co-Director of CEEO

Merredith Porstmore  
Associate Director of CEEO

Elissa Milto  
Director of Outreach

Jessica Scolnic  
STOMP Manager

Executive Board

Emily Taintor  
Class of 2015

Matt Mueller  
Class of 2015

Ali Boreika  
Class of 2017

Alex Pugnale  
Class of 2016

Daniela Torres  
Class of 2016

Devyn Curley  
Class of 2015
Tufts STOMP

STOMP Statistics

STOMP had another record-breaking year, with 63 fellows working for the program. These fellows worked in 34 classrooms, impacting approximately 630 K-8 students, the largest number in STOMP history!

![STOMP Growth](image)

The general make-up of the fellows maintained a 2:1 ratio of females to males, which is highly unusual in a group comprised of mostly engineering students. Of the 42 female STOMP fellows, 26 are engineering students. Therefore, 42% of STOMP fellows are female engineering students. This is a greater percentage than the total female population in the School of Engineering which is 29% for undergraduates and 31% for graduate students. The 46 undergraduate engineering students in STOMP make up 5% of the total undergraduate engineering enrollment. The 26 undergraduate female engineers make up 11% of the total female undergraduate engineering enrollment.

### Fellow Class Distribution

<table>
<thead>
<tr>
<th>Class</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td># of freshmen</td>
<td>10</td>
</tr>
<tr>
<td># of sophomores</td>
<td>24</td>
</tr>
<tr>
<td># of juniors</td>
<td>16</td>
</tr>
<tr>
<td># of seniors</td>
<td>10</td>
</tr>
<tr>
<td># of graduate students</td>
<td>2</td>
</tr>
</tbody>
</table>

### Fellow Gender Distribution

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td># of female fellows</td>
<td>42</td>
</tr>
<tr>
<td># of male fellows</td>
<td>21</td>
</tr>
</tbody>
</table>

### Fellow School Distribution

<table>
<thead>
<tr>
<th>School</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td># of fellows in Arts and Sciences</td>
<td>15</td>
</tr>
<tr>
<td># of fellows in Engineering</td>
<td>48</td>
</tr>
</tbody>
</table>

![Figure 1: Number of fellows and students by year](image)

![Figure 2: STOMP fellow statistics](image)
STOMP Statistics

Mechanical engineering is the most common major amongst fellows (33% 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 24% of STOMP; these majors include physics, mathematics, biology, economics, and child development.

The 34 participating classrooms this year were spread across six local communities and 15 locations. As in previous years, fifth grade was the most represented grade in STOMP with 15 classrooms and we served students in grades 3-12.

<table>
<thead>
<tr>
<th>Participating Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerville</td>
</tr>
<tr>
<td>Arthur D. Healey School, Dr. Albert F. Argenziano School</td>
</tr>
<tr>
<td>Medford</td>
</tr>
<tr>
<td>St. Joseph’s School, Columbus Elementary, Brooks School</td>
</tr>
<tr>
<td>Cambridge</td>
</tr>
<tr>
<td>International School of Boston, Vassal Lane Upper School</td>
</tr>
<tr>
<td>Winchester</td>
</tr>
<tr>
<td>Vinson Owen Elementary School, Acera</td>
</tr>
<tr>
<td>Boston</td>
</tr>
<tr>
<td>Josiah Quincy Elementary School, Winship Elementary School, Codman Academy, Sarah Greenwood School</td>
</tr>
<tr>
<td>Malden</td>
</tr>
<tr>
<td>Linden STEAM Academy, Malden YMCA</td>
</tr>
</tbody>
</table>

Number of Classrooms by Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third</td>
<td>1</td>
</tr>
<tr>
<td>Fourth</td>
<td>10</td>
</tr>
<tr>
<td>Fifth</td>
<td>15</td>
</tr>
<tr>
<td>Sixth</td>
<td>4</td>
</tr>
<tr>
<td>Seventh</td>
<td>1</td>
</tr>
<tr>
<td>Eighth</td>
<td>1</td>
</tr>
<tr>
<td>Combined 6-8</td>
<td>1</td>
</tr>
<tr>
<td>High School</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 3: 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 2014-2015, nine schools out of the participating 15 were in these areas. Below is a table describing the ethnic distribution in percentages for these schools during the 2014-2015 school year:

*Averages

Figure 4: Ethnic distribution for STOMP supported schools in core Tufts communities

<table>
<thead>
<tr>
<th></th>
<th>African Amer.</th>
<th>Asian</th>
<th>Hispanic</th>
<th>White</th>
<th>Native Amer.</th>
<th>Multi-Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston*</td>
<td>33.6</td>
<td>8.5</td>
<td>40.9</td>
<td>13.8</td>
<td>0.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Medford*</td>
<td>15.3</td>
<td>8.6</td>
<td>9.5</td>
<td>62.8</td>
<td>0.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Somerville*</td>
<td>10.7</td>
<td>8.5</td>
<td>42.3</td>
<td>36.0</td>
<td>0.0</td>
<td>2.4</td>
</tr>
</tbody>
</table>
Additionally, STOMP also 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></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>47.4</td>
<td>29.8</td>
<td>19.5</td>
<td>71.9</td>
<td>49.3</td>
</tr>
<tr>
<td>Medford*</td>
<td>23.8</td>
<td>7.6</td>
<td>18.0</td>
<td>43.0</td>
<td>25.3</td>
</tr>
<tr>
<td>Somerville*</td>
<td>50.3</td>
<td>17.4</td>
<td>21.0</td>
<td>57.5</td>
<td>35.5</td>
</tr>
</tbody>
</table>

* Averages

Figure 5: Data on 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

For a by-school breakdown of the above data, please see Appendix A.
Checking in with STOMP Alumni

Griselle Ong, Computer Science, Class of 2013

For the past two years, I’ve been working as a software developer at Bloomberg L.P. in New York City. It’s been quite a learning experience seeing how industry software is built and maintained, and how different this is from finishing a 2-week long programming assignment for class.

While I’ve continued to grow myself personally as a software developer, I’ve also sought volunteer opportunities as a proponent of STEM education for youth. In the past year, I’ve been a regular mentor at CoderDojo NYC, an organization that hosts free monthly coding clubs for kids. Bloomberg L.P. has also given me numerous opportunities to contribute to their philanthropic STEM initiatives. Last spring, I assisted in a coding workshop for 9th graders and most recently I spoke with middle school and high school girls on my career as a software developer. Through these experiences, I’ve met other passionate individuals who have exposed me to many more resources, events and initiatives surrounding STEM education in the city.

My experience as a STOMP teacher has helped me become an effective contributor in my volunteer work. I’ve been able to assist in making effective lesson plans and worksheets and in giving advice to new volunteers. I’ve been comfortable speaking to kids of all ages and have hopefully inspired some of them to continue their love for building. More importantly though, it is my experience at STOMP – in the classroom and in those weekly meetings as we discussed STEM research – that will always remind me why engineering education is valuable.

Figure 6: Griselle Ong, Software Developer at Bloomberg LP
Meeting Schedule: Fall 2014

In the fall semester, the weekly meetings focused on exposing STOMP fellows to new ideas in engineering education. Executive Board members each led a meeting about a topic of interest, and experienced STOMPers were encouraged to share their knowledge.

Fall Semester 2014

9/10/14 A meeting only for returning STOMP fellows during which we did a LEGO building introduction game, and compiled advice for new STOMP fellows.

9/15/14 New STOMP fellow training session was a combination of lecture and activities to prepare new fellows for their first semester. Topics included but were not limited to history of STOMP, expectations in classroom, structuring activities, and the engineering design process.

9/17/14 First full meeting of the year. Introduced the Executive board, went over the new website, and had all fellows complete and evaluate the aluminum foil boats activity.

9/24/14 All STOMP fellows toured the new location of the CEEO and then discussed curriculum development with Education Specialist Lija Yang.

10/1/14 First draft of curricula was due, Mini groups discussed and revised units.

10/8/14 CEEO Graduate Student Brian O’Connell led a discussion about the role of makerspaces in STOMP and how to utilize available campus resources for designing and building in the context of STOMP.

10/15/14 Executive Board member Daniela Torres shared her experiences at a recent Maker Faire and discussed bringing STOMP to a Faire in the future. Also had mini group discussions about how units have changed so far.

10/22/14 Executive Board member Emily Taintor led a brainstorming and development session about incorporating innovative technologies such as “Paper Circuits” to STOMP.

10/29/14 CEEO Co-Director Chris Rogers spoke about his philosophies on engineering education.

11/5/14 CEEO Graduate Student Jessica Swenson discussed her work engaging girls in engineering and how to structure non-gendered STOMP units.

11/12/14 Executive Board Members Matt Mueller and Devyn Curley presented a forum for STOMPers to give two minute talks on any relevant topic of interest.

11/19/14 Professor of Child Development Marina Bers spoke about her work in the DevTech group at Tufts.

12/3/14 Last meeting of the semester: Fellows filled out a survey about their experiences.
Tufts STOMP

Meeting Schedule: Spring 2015

In the spring semester, the STOMP semester was unfortunately impacted by an extraordinary number of snow days. Despite this, meetings continued to be productive times for STOMPers to share their experiences and work on their curricula.

Spring Semester 2015

1/15/15 Returning STOMP fellow meeting: Discussed with previous STOMP partner about areas of strength and for improvement in STOMP. We also discussed topics of interest for the semester.

1/21/15 Returning STOMP fellows created “hand-off notes” for the new fellows taking over their fall classrooms to relay important information. New partners also met and contacted their teachers.

2/4/15 Executive Board members presented units of which they were particularly proud. Mini groups discussed curriculum development in the context of learning goals.

2/18/15 We broke into small groups to work on projects using the Hue Animation Studio software. Groups illustrated a concept they wanted to teach their classes in the next few weeks.

2/25/15 Executive Board members Ali Boreiko and Emily Taintor presented about their work on the new website. Fellows Jen Scinto and Jordan-Tate Thomas presented on their innovative robotics unit from the fall.

3/4/15 STOMP fellows presented two-minute talks on topics of interest. Alex Rappaport discussed bringing the chemical process of “spherification” to his students, Matt Mueller presented on his favorite high school physics teacher, and several fellows shared different summer experiences in engineering education.

3/11/15 After a quick discussion about what makes good activity introductions and wrap ups, STOMP fellows had to extemporize in front of the group in response to different potential classroom scenarios.

4/1/15 After reviewing a few interesting final projects from the fall, STOMP fellows brainstormed in small groups their strategies for wrapping up the semester.

4/15/15 STOMP fellows participated in a “Knowledge Café” to brainstorm on different topics concerning the future of STOMP. Topics included but were not limited to: STOMP in five years, mini groups, the supply closet, the social experience, and the new STOMPer experience.

4/22/15 Final meeting: surveys, and pizza.
In the Classroom

This year, STOMP fellows focused on sharing their expertise with one another as well as developing units around topics completely new to STOMP, such as chemical engineering. Some creative units designed by STOMP fellows include:

- **The Intersection of Art and Engineering**: Ali Boreiko and Daniel deCordoba
- **Service Learning with Robotics**: Alana Lustenberger and Rachel Eisenberg
- **Engineering Design through Types of Engineering**: Kirsten Jorgensen and Shanice Koh
- **Investigating the Internet and Website Design**: Dan Luo and Camila Solorzano
- **Structural Engineering via Architectural History**: Devyn Curley and Camille Mbayo
- **Engineering your World**: Alex Rappaport and Amanda Rock

Below is the outline of “Engineering your World” by Alex and Amanda. The unit focused on enabling students with specific engineering skills each week as it took students through different creative, discipline specific engineering projects.

<table>
<thead>
<tr>
<th>Activity #</th>
<th>Lesson</th>
</tr>
</thead>
</table>
| 1 | **Engineering at Sea: Tin Foil Boats**  
   In this classic STOMP intro activity, students design and build boats using only tin foil. Students then test their boats in a tub of water by loading them with pennies. They then discuss strengths and weaknesses of different designs.  
   **Engineering Skill**: Setting engineering goals |
| 2 | **Engineering from the Sky: Egg Drop**  
   In a variation of this well-known engineering activity, STOMP students were tasked with predicting what effect different materials would have when incorporated into their egg-protecting devices. After the eggs were dropped, students compared the predicted effect of each design decision to the actual outcome.  
   **Engineering Skill**: Planning before building |
| 3 | **Engineering in the Garden: Hydroponics**  
   This STOMP activity has never been done before and had students use recycled materials to design and build homemade hydroponics systems with a nutrient enriched liquid base that fed the garden via a rope wick. The engineering was supported by scientific experimentation: students investigated which non-soil growing medium would work best for each of four different kind of plant grown. Teams made two systems that each grew the same plant – the only difference in their systems was the growing medium. This project continued for the entire semester after the systems were built. In each team, students took on different roles to maintain the |
<table>
<thead>
<tr>
<th></th>
<th>Engineering Skill: Teamwork and making group decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><strong>Engineering at Home: Squishy Circuits</strong>&lt;br&gt;Another well-known STOMP activity that Alex and Amanda put their own spin on. Students used conductive dough, batteries, and LEDs to design and test electrical circuits. Students were given incomplete or broken circuits, and had to find and fix each problem.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Engineering in Action: Elevate</strong>&lt;br&gt;Students created as many structures as possible that could lift a rock off the ground by one foot. In this way, students discovered all the different forms of simple machines, as well as how to combine them.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Engineering in History: Catapults</strong>&lt;br&gt;Students made rubber-band powered catapults to shoot a ping-pong ball as far as possible. Students learned about systematic variable variation to discover the best possible design. Students tested every 10 minutes and then discussed the impact of each change.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Engineering in the Kitchen: Gummy Polymers</strong>&lt;br&gt;Using chemical engineering, students transformed normal drinks like lemonade, sports drinks, and smoothies were turned into squishy edible polymer beads. Students performed chemical observations of the transformation process and discussed states of matter, chemical reactions, and experimentation. Students then performed a variety of tests on their results such as a bounce test, stretch test, and pierce test.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Engineering in Nature: Volcanoes</strong>&lt;br&gt;Students made paper-mache volcanoes and used chemical engineering to create the most realistic explosion. After studying volcanic eruptions in science, students combined ten unmarked chemicals in various combinations to discover the best chemical reaction.</td>
</tr>
</tbody>
</table>
Publicity: STOMP T-Shirt

For the seventh year in 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. STOMP Executive Board member Emily Taintor created the design. Below, the shirt is modeled by STOMPer Jen Scinto.

![Figure 7: Front view of the STOMP T-shirt](image1)

![Figure 8: Back view of the STOMP T-shirt](image2)

Publicity: Events

STOMP participated in many publicity events throughout the Tufts community this year, all of which are run annually either by Tufts undergraduates or the Office of Community Relations. For each event, STOMP fellows hosted a table with two activities for the children to rotate between. One activity involves the exploration of circuitry using batteries, wires, LEDs, and playdough, affectionately known as “Squishy Circuits.” The second activity is more structured, with a design challenge to build and program a candy pushing robot out of LEGO NXT kits. With the latter allowing participants to keep some of the candy they push, it is easy to guess the crowd favorite.

Halloween on the Hill: This is an annual event run by Tufts undergraduates during which young children dress up and travel around the campus in groups, making scheduled stops at various stations, eating candy all along the way.

Kids Day: Similar to Halloween on the Hill, children from Medford, Somerville, and Chinatown go around in groups of five to ten doing various activities hosted by Tufts undergraduates. This event is a Tufts staple as it has been occurring annually for more than fifty years.

Community Day: Tufts invites all members of the Medford/Somerville community onto campus for a day of food, art, and family entertainment. STOMP runs a table in the activities area to share STEM with community members of all ages.

Financial Statements

STOMP’s expenditures for fiscal year 2014 (2014/2015 academic year) totaled $80,820. Support comes from the Service Learning Grant (Tufts Department of Civil and Environmental Engineering) and the Tufts School of Engineering Dean’s Office, which supports the STOMP Manager position.

Figure 10: STOMP fiscal year 2014 expenditures: $80,820.

STOMP continues to be supported by carry-over from the LLL Foundation gift challenge and other previous grants and gifts. This year saw a marked decrease in donations.

Figure 11: STOMP fiscal year 2014 revenue: $225,412.

We thank our 2014-15 donors: Leila Shakkour and Mike Thorne (LLL Foundation) and Mr. & Mrs. Thomas & Jill Pappas. Join us by visiting Tufts University’s secure donation site http://giving.tufts.edu/make_a_gift/ and label your donation as CEEO-STOMP.

STOMP Funding

In fundraising results for fiscal year 2014, generous friends and alumni made gifts and pledges to STOMP totaling $40,000. Thanks to these donations there is over $200,000 in the STOMP account. This support will maintain the excellence of STOMP and is providing operating funds, seed funding for new initiatives, and $120,000 for a STOMP challenge campaign which began in the spring.

We are excited to report that we have raised more than $50,000 so far in the first year of the STOMP matching campaign! Help us reach our goal of $120,000. 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, labeling your donation as CEEO-STOMP at http://giving.tufts.edu/make_a_gift/

Figure 12: Two students work together to program an EV3 LEGO brick

New CEEO Space and STOMP

In September 2014, the CEEO moved into its new location at 200 Boston Avenue, Suite G810. STOMP held its second full meeting of the semester at the new location to give all STOMP fellows a tour, and discuss the role of the CEEO in STOMP. Fellows were encouraged to come to the new space often for planning meetings, obtain supplies, and testing out activities.

![Figure 13: 200 Boston Avenue](image)

The new location of the CEEO is also home to Jumbo’s Maker Studio, a place where all people in the Tufts community (including STOMP fellows) can go to design and create. The Maker Studio was publicized at several STOMP meetings, and fellows are in the process of developing more ways to link STOMP with the Maker Studio. This commitment has manifested itself into an undergraduate leadership position (see page 30).

![Figure 14: Panoramic view of Jumbo’s Maker Studio](image)
In October of 2014, STOMP Manager Jessica Scolnic traveled to Barcelona to spend five weeks teaching and learning at Colegio Montserrat, an innovative pre K-12 school. The school is built on principles of multiple intelligences, and teachers are free to experiment with new projects and teaching styles. Montserrat also is one of the first schools to teach robotics to all students from pre-K through high school. Robotics at Montserrat is not an elective: everyone participates. Classes are taught in English, Catalan, and Spanish.

While there, Jess taught three sections of robotics for high school students using a new technology she developed for her Master’s thesis. The technology, called the EVDuino, allows students to use both LEGO Robotics and the open source microcontroller called Arduino simultaneously in their projects. Students at Montserrat were able to explore a wide array of new sensors, program using LabVIEW, and explore projects such as classroom automation and robot zoo. Jess also visited several other local schools doing robotics, and discussed the possibility of starting STOMP at Montserrat.

In June, Executive Board member Daniela Torres continued the partnership with a two-week visit to Montserrat. There were three main focuses during her stay: 1) to spread the goals of STOMP and STEAM (Science, Technology, Engineering, Art, and Math) education, 2) to introduce the capabilities of DevTech Research & Professor Marina-Bers’ robot, KIBO, and 3) to begin planning how their brand new makerspace would be used.

To meet these goals, Daniela taught several robotics classes to a variety of students. Daniela also led professional development for kindergarten and first grade teachers using the Kibo robot. Several meetings with teachers and administrators took place to discuss new strategies for integrating STEAM projects and STOMP teaching philosophies into daily life at Montserrat. This planning also incorporated many discussions about a brand new makerspace at the school—including getting all stakeholders ideas about projects that could be done, tools that could be utilized, and management of the space.

We are excited for the partnership between the CEEO, STOMP, and Montserrat to continue into next year.
As of last summer, the STOMP website had undergone a complete overhaul and looked like this:

The website continued to be improved by Webmasters and Executive Board Members Alison Boreiko and Emily Taintor. With a new appearance, it is easier for STOMP fellows to access resources and upload new activities or unit pages. New content also continues to be added by Executive Board Members and STOMP summer interns. Screenshots from the current website can be seen below:

Discover Engineering Day

On February 28, 2015, STOMP Executive board member Alex Pugnali coordinated “Discover Engineering Day” as the culminating event to conclude Tufts University’s “Engineering Week.” Engineering Week is a time-honored Tufts tradition that was revived this year by the Engineering Mentors student group, in honor of the 150th anniversary of the School of Engineering.

Over 120 children from the Medford, Somerville, and Cambridge areas came to the Tufts Engineering building (Anderson Hall) to participate in a variety of activities designed to pique their interest in engineering. Forty undergraduate volunteers, including fifteen STOMP fellows, helped to plan and run the event. At the beginning of the day, STOMP fellows Grace Reilly and Daniela Torres gave short engaging presentations on the different types of engineering that they study at Tufts.

After the introduction, STOMP fellows taught two different activities several times throughout the day. One activity, LEGO robotics “Silly Walks,” had students build a contraption that moved without wheels, giving it a “silly” cantor. The other task, a Novel Engineering activity, had students build sturdy structures for Dorothy from *The Wizard of Oz*.

STOMP collaborated with other university organizations to put on the event, such as the Society of Latino Engineers and Scientists (SOLES) and the Tufts chapter of the American Institute of Chemical Engineers (AIChE.) These other student groups also helped to coordinate and plan the event and run activities during the day.
Continuation of W-STOMP Workshop

Made possible by a gift from Verizon in 2011, W-STOMP (Women in STOMP) focuses on engaging girls in engineering through hands-on activities emphasizing robotics, building, and making. While the Verizon gift has run out, W-STOMP continues to be an active part of STOMP. For the past four summers, a group of W-STOMP girls have been invited to the CEEO for a week long workshop. Many of the girls are repeat attendees. This year, five students attended from July 6th to July 10th. Three of the students have attended all four years and two had only attended the year before. The workshop this year was intentionally small so each girl would be able to work on self-directed projects and prototype using the laser cutter and 3D printing machines.

This year, participating girls were given freedom to pursue personal projects using skills they had learned in past workshops such as 3D printing and LEGO robotics. Students also learned new skills like laser cutting. On Day 1, students completed a few introductory projects. First, they created 2D designs using computer software and laser cut projects including key chains, picture frames, and earrings.

After laser cutting, students completed an engineering design challenge where they created a mechanism to help a ping pong ball travel down a zip line as fast as possible. Other projects throughout the week included game design and clock making. Students also built LEGO robots to navigate an obstacle course to capture a flag.

The success of W-STOMP has created a second workshop, Girls Engineering and Design, to introduce a new group of girls to engineering. This workshop will focused more on building fundamental design and engineering skills.

Figure 17: Two students prepare to race their LEGO cars (left), and a laser cut Monopoly board that has a customized “Hollywood” theme (right).
Planned Changes for 2015-2016

2015-2016 Changes

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

- Jump-Starting STOMP Research
- Improving STOMP Fellow Resources
- Growing the STOMP Reputation
- New Roles for Executive Board Members
- New Meeting Structures

Many of these ideas will continue to grow and develop in the coming year. Those plans are detailed on the following pages.

Figure 18: 2014-2015 STOMP group photograph
Planned Changes for 2015-2016

Jump Starting STOMP Research

Over the years, research on STOMP has looked at the impact on STOMP on a particular stakeholder. Adam Carberry’s work found that STOMP fellows (in addition to other students involved in service-learning experience) reported that the experience impacted their engineering self-efficacy, professional skills, and even some of their technical skills. His project also found a difference in engineering design practices between students involved service-learning. Elsa Head looked at how STOMP impacted participating teachers’ understanding of engineering. However, to date, we have not looked at how STOMP impacts K-12 students and the dynamics of how interactions in STOMP affect the classroom. In fall of 2015, a new graduate student joined STOMP from Tufts STEM Education program to begin research on these areas of STOMP. Having a graduate student dedicated exclusively to research on STOMP will help us to better understand the program in order to make improvement as well as help to demonstrate the power of STOMP to funders and supporters.

Research on STOMP

- Carberry, A. (2010). *Characterizing learning-through-service students in engineering by gender and academic year*. (3403320 Ph.D.), Tufts University, Ann Arbor. Dissertations & Theses @ Tufts University; ProQuest Dissertations & Theses Global database.


- Head, E. (2011). *Teachers Teaching Engineering Design in the Tufts University Student Teacher Outreach Mentorship Program*. (1500408 M.S.), Tufts University, Ann Arbor. Dissertations & Theses @ Tufts University database.

In last year’s report, four specific resources were listed as goals for 2013-2014. Below, these goals are analyzed and progress is described.

1. **Formalized STOMP Units:**
   Three classic STOMP units were formalized during August of 2014 and can now be found on the STOMP website. The units posted are “Types of Engineering,” “Intro to EV3 Programming,” and “Intro to LEGO Robotics.” These units not only give sample activities, but also tips for STOMP fellows and possible variations on each activity. These can be accessed at [http://sites.tufts.edu/stompactivitydatabase/unit/](http://sites.tufts.edu/stompactivitydatabase/unit/).

2. **Classroom Dossiers:**
   Last fall, each STOMP fellow team received a folder of information pertaining to their classroom (teacher information, developmental tips for the age group of students, etc.) Teams were asked to hold on to the folder, add to it, and return it at the end of the semester. While STOMP fellows expressed that these folders were helpful to them, they did not add to the folders or return them at the end of the semester. In the spring semester, this idea was adapted into having each STOMP team write a “Hand-Off Note” to the fellows taking over their classroom. These notes described the previous curriculum, and any tips for working with the classroom. STOMPers expressed that these notes were extremely helpful as they entered new classrooms. The Hand-Off Notes will be continued this year.

3. **Updated STOMP Fellow Handbook:**
   The STOMP Handbook was updated during the fall of 2014 and posted on the STOMP website. It was also handed out to all new fellows during “New STOMP Fellow Training” each semester. The updated handbook is accessible at: [https://sites.tufts.edu/stomp/files/2014/11/STOMP-Handbook.pdf](https://sites.tufts.edu/stomp/files/2014/11/STOMP-Handbook.pdf)

4. **Programming Assistance Tools:**
   With the implementation of new EV3 hardware and software, the STOMP Robotics training sessions took a new form this year. All STOMPers who had 1) never worked with robotics before or 2) planned on teaching robotics in their STOMP classroom were required to attend. We held several training sessions and asked participants to fill out a brief survey where they expressed their level of proficiency with robotics, and listed one thing they wanted to learn at the training. This information allowed Executive Board Members who led the trainings to better plan activities and information for each session. STOMP fellows expressed that this process helped focus the trainings and they noticed a dramatic improvement in the quality of trainings over previous years.
Planned Changes for 2015-2016

Growing the STOMP Reputation

This year, STOMP became recognized as a student-run organization under the umbrella of the Tufts Community Union Senate. This was done to gain access to the activities fair, which is a large event on the residential quad where each student group sets up a table. This serves as an easy way for underclassmen to gain exposure to many different student groups at once. For STOMP it is a fantastic recruitment tool. Due to the necessity of hiring students early in the fall, application deadlines are always before the fair. Thus the goal of the fair has been to collect as many emails of interested students as possible to then email them towards the end of the semester with the spring application. This event was very successful; in the fall alone we acquired roughly seventy emails. Once the event was over the benefits of TCU recognition continued. As the undergraduate liaison to STOMP, Devyn Curley attended a number of Senate events where he was able to talk with members of the Senate and fellow student leaders and discuss potential collaborations. He also gave feedback on how Tufts Senate can better support STOMP.

Throughout the year, STOMP held T-Shirt days on Wednesdays. This directly contributed to STOMP’s visibility on campus, and often prompted many questions of “what is STOMP?” This is such a great question because the STOMPers we hire are so enthusiastic about the program and STEM education. Wearing a shirt to prompt this question sets STOMPers up in a natural way to share their passion and excitement with the Tufts community.
New Roles for Exec Board Members

In last year’s report, a few specific roles were outlined for Executive Board members, and it was stated that new roles would be assigned as needed. Those roles were:

1. Publicity Manager
2. Media Manager
3. Website Managers

Devyn Curley, the Publicity Manager for 2014-2015, ensured STOMP participated in many on campus events (as described in page 14) and also that STOMP was recognized as an official campus organization, which had not previously been done. Additionally, Devyn ensured STOMP was present at all campus activities fairs where students learn about and sign up for on-campus activities. The Publicity Manager role was a success and will continue this year.

Daniela Torres, the Media Manager for 2014-2015, began brainstorming new ways to make managing classroom photos and media materials easier. A secure and shared cloud-based folder was created to compile STOMP photos. Official STOMP photographers were appointed and took photos at events throughout the year. This role is expected to grow next year. More ideas and implementation strategies are needed concerning how to collect and secure great STOMP photos, as well as keep track of completed photo release forms.

Alison Boreiko and Emily Taintor, Website Managers for 2014-2015, made several overall improvements to the STOMP website structure and appearance, as outlined above (page 19). New features such as a calendar and easier ways for STOMP fellows to upload content were implemented. The website will continue to improve as STOMP leadership strives to make the website a place for fellows to be actively engaged with STOMP.

In addition to the roles outlined in last year’s report, all Executive board members took on more leadership this year when manager Jessica Scolnic was in Barcelona in the fall of 2014. Each exec board member took charge of one Wednesday meeting and fifteen to twenty STOMP fellows. The program ran very smoothly and the Executive board members excelled in their new roles. In future years, Executive board members may continue to be in charge of specific meetings.
Planned Changes for 2015-2016

New Meeting Structures

As described in last year’s report, the experience levels of STOMP fellows are highly variable and therefore a more varied meeting structure is needed to ensure all fellows are engaged during meetings. This year, several new meeting structures were implemented.

The most successful new meeting feature was having experienced STOMP fellows give talks on topics relevant to STOMP classrooms and STOMP fellows. Each semester, one meeting was held for fellows to get up and speak in front of the group about a chosen topic. Topics ranged from teaching at summer engineering courses, to personal projects, to favorite high school science teachers. These meetings consistently received highest marks from STOMP fellows and will be continued next year.

Another new meeting structure consisted of spending half the meeting time with the large group and half in mini groups. This allowed STOMP fellows to learn something new or work on a skill more formally, as part of the large group, and then reflect on their new knowledge in depth in their mini group.

Figure 19: STOMP Fellow Grace Reilly presenting on Biomedical Engineering during a Wednesday STOMP Meeting
Planned Changes for 2015-2016

Publications and Presentations

In April, 2015 CEEO graduate student Carissa Brownnotter and visiting teacher Jonathan Dietz started the website “Engineering K12 Massachusetts,” in efforts to compile resources about engineering education innovators across the state. STOMP is listed on the site as a leader in the field.


In March 2015, STOMP was featured on the American Society for Engineering Education’s student news blog, The Accelerator.

“From the Student Division…Tufts University.” Published by Jen Pocock on March 24, 2015. http://blog.engineeringstudents.org/?p=4882

In March 2015, STOMP was cited in an undergraduate thesis analyzing strategies for implementing a computer science outreach program at Worcester Polytechnic University.


In November 2014, STOMP was featured in “Jumbo Engineer,” the Tufts Admissions magazine on page 28.


In September 2014, STOMP was publicized when CEEO Associate Director Merredith Portsmore and Educator in Residence Dan Wise visited the Expeditionary Learning National Conference to lead a session titled “Bringing Engineering into the Classroom: The Power of Real-World Design.”

Areas of Focus for 2015-2016

The following areas will be a focus for change during the 2015-2016 academic year. These changes may take more than one year to complete and may require multiple iterations.

- New leadership roles for STOMP fellows
- Innovations on the new STOMPer experience
- New classroom kits

Additionally, many initiatives that began last year will be continued. Improving STOMP fellow resources is still a high priority and resources such as a set of informational videos 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 our new graduate student began in the fall of 2015.

Figure 20: A STOMP classroom creates a human circuit
New Leadership Roles for STOMP Fellows

In the upcoming year, experienced STOMP fellows will have the opportunity to become committee heads, leading a small number of dedicated fellows in making larger changes to STOMP as a whole. More positions may be added as needed. However the following three committee head roles have been defined:

1. Makerspace Liaison
   This position will facilitate STOMP fellow activity in Jumbo’s Maker Studio. This fellow will also be responsible for ensuring some STOMP classes utilize the makerspace, providing training events for fellows, and developing resources to help STOMP fellows bring the makerspace into STOMP.

2. American Society for Engineering Education Chapter President
   This position, previously held by a CEEO graduate student, will now be held by an enthusiastic STOMP undergraduate. The fellow in this role will hold events under the ASEE umbrella (that are open to more than just STOMP fellows) and help STOMP fellows be more involved with the ASEE community. This fellow will also bring in new engineering education research into STOMP classrooms by presenting at Wednesday meetings and meeting directly with fellow teams.

3. Curriculum Development and Organization Lead
   The fellow filling this role will ensure that resources are continually developed to help STOMP fellows in the curriculum development process. He or she will also publicize STOMP best practices in planning, curriculum development and classroom organization. STOMP fellows who are struggling with planning or curriculum development will be able to go to this leader for assistance.

In addition to their specific roles, the group of three committee heads will meet as a group every two weeks to discuss engagement strategies and troubleshoot any challenges. The group will also meet with the STOMP manager at this point to give updates about their activity.
Planned Changes for 2015-2016

New Kits

STOMP fellows struggle to transport materials to and from their classrooms. With craft materials, gathering everything in time can be a challenge. With robotics kits, the boxes are heavy, bulky, and spill easily. Additionally, the CEEO would like to cut down on the time STOMP fellows spend sorting robotics kits each semester.

To meet these goals, materials kits will be redesigned. The goals for each new kit are outlined below.

1. LEGO Robotics Kits
   - **Smaller**: Fewer pieces will be included and new boxes will be purchased that take up less space than the LEGO kits.
   - **More spill-proof**: The new boxes will have latches so that when dropped the kits do not break or open up.
   - **Faster to sort**: The number of each piece in the kit will not need to be exact, so that when sorting, fellows can spend less time counting
   - **Expandable based on activity**: Small boxes of pieces can be placed inside each larger box if certain activities require more or different pieces.

2. Squishy Circuits Kits
   - **Convenient**: Currently, STOMP fellows have to gather LEDs, batteries, Play-Doh, and other materials to do this activity in class. These kits should be all in one box, a class set that fellows can just pick up.
   - **Consistent**: Since fellows will no longer have to compile the kits each time they wish to do this activity, the materials for each implementation of the activity will always be consistent.

3. Tin Foil Boats Kits
   - **Convenient**: Currently, STOMP fellows have to gather tin foil, assorted weights, and a testing basin for this activity. STOMP fellows struggle to find appropriate weights (like coins) and testing environments.
   - **Consistent**: Like the Squishy Circuits Kits, these pre-assembled kits will ensure that each implementation of the activity used consistent materials

These kits will all be kept track of by a check-in/check-out system that will be developed during fall 2015.
Planned Changes for 2015-2016

Innovation on the New STOMP Fellow Experience

Outline of Goals

1. Expansion of resources to STOMPers as they enter the program
2. Implementation of Mentorship Program
3. Piloting of Shadow Program

The first innovation that was developed this past summer was a series of training videos for newly hired STOMP fellows. These videos walk STOMPers through teacher communication, introducing a lesson, setting classroom norms, the history of STOMP, and wrapping up a lesson. These are all skills that have been and will continue to be taught in STOMP training, but they are so valuable we want STOMPers to have access to the instructions at any time throughout their semester and throughout their career as STOMP Fellows. Each video is kept concise and informative for easy viewing and is full of enthusiasm and information.

A major focus of fall 2015 will be the implementation of a new Mentorship Program. In STOMP-wide discussions at the end of last semester, many STOMPers pointed to how useful having a mentor would have been upon first entering the program. In the past, new hires have been paired up with experienced STOMPers to serve as guides and mentors, and this will continue to happen. Unfortunately, this system often leads STOMP fellows with one semester of experience working with new hires, which is not enough experience to act as an effective mentor. A mentor would be a fellow with two full semesters of experience and the pairing would be set throughout their STOMP careers. This promotes a culture of constant learning and progression, as no fellow is ever too experienced to be without guidance and advice.

While all new hires will have a mentor, mentors will all be volunteers since the role of a quality mentor cannot be forced. Mentor and mentee will talk at least once a week, updating one another on their classroom, curriculum, and partner/teacher relationships. Mentors will model teaching behavior, set standards for curriculum development, and provide constructive feedback on all things STOMP. This position will provide the mentors stronger alumni connections, serve as a reminder of good practices (practice what you preach!), and invests them further into the future of the STOMP program.

Finally, a shadowing program will be piloted as a combination recruitment tool and means of acclimating fellows to the program before being hired. As a recruitment tool this program serves to engage applicants who missed the deadline or were just under the hiring threshold. Unpaid, they will be invited to sit in on STOMP meetings and shadow a STOMP class. It is very common for undergraduates, especially underclassmen, to overcommit themselves quickly in their college careers and do not leave space for STOMP. If they showed potential as a STOMP Fellow, shadowing will give them exposure to STOMP, providing them experience and a sense of how the job fits them. The program also provides the manager with a pool of applicants who have proven interest and acclimation to the program. Thus, as new hires, they have already experienced so much of STOMP. They will be better prepared, thereby more able to focus their efforts on teaching.
# Appendix A

## Ethnic Distribution and High Needs Data for STOMP Supported Schools in Core Tufts Communities by School

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 2014-2015 school year.

### Ethnic Distribution and High Needs Data

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<th>Asian</th>
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<th>White</th>
<th>Native Amer.</th>
<th>Multi-Race, Non-Hispanic</th>
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