Student Teacher Outreach Mentorship Program

STOMP Teacher Manual

2008 – 2009

http://www.stompnetwork.org/

Tufts UNIVERSITY | Center for Engineering Education and Outreach

Introduction

This packet provides teachers interested in STOMP (Student Teacher Outreach Mentorship Program) with materials about where to learn more about the program, what can be expected from the STOMP fellows who assist in the classroom, what responsibilities teachers have in the STOMP environment, and where to seek more information.

We hope that this Teacher Manual will help you understand how you can get involved with STOMP and what the commitment entails. Please do not hesitate to contact us if you have any questions.

Thank you,

STOMP Management Team

Tufts University's Center for Engineering Educational Outreach

http://www.stompnetwork.org

Table of Contents

1.0 What is STOMP?

STOMP (Student Teacher Outreach Mentorship Program) is an outreach program that started at the Center for Engineering Educational Outreach (CEEO) at Tufts University and has expanded to other universities across the country. STOMP works with teachers and after school program coordinators to integrate engineering into K-12 classrooms. STOMP fellows are engineering students from Tufts University who support schools near the Tufts University Medford and Boston campuses. The fellows assist the classroom teachers with hands-on engineering activities throughout the semester.

1.1 STOMP Mission

The mission of STOMP is to promote K-12 engineering education in the communities near the Tufts Medford and Boston Campuses. This involves providing teachers with classroom assistance in implementing engineering curriculum, as well as developing resources to aid educators in long-term sustainability of engineering education.

1.2 What are the benefits of STOMP?

STOMP fellows work with teachers to introduce engineering concepts in the classroom using hands-on activities. The K-12 students benefit from having positive role models, increased self-confidence, and a new and different approach to math and science learning relevant to state standards and individual classroom curriculum goals. Teachers benefit from experiencing a new style of teaching and receiving assistance (engineering materials and fellows) so that they can lead activities that may not have otherwise been feasible. Fellows benefit from being involved in the community, reinforcing their engineering skills through teaching, and interacting with K-12 education.

1.3 Who are the STOMP fellows?

The fellows range from freshmen to graduate level engineering students at Tufts

University. Typically, classrooms are paired with one experienced and one novice STOMP fellow. This approach both provides the teacher with additional support and helps our inexperienced STOMP fellows learn from our expert outreach participants.

In addition in-the-classroom experience, the STOMP fellows receive training prior to their first visits to their partner schools. The sessions familiarize the STOMP fellows with educational engineering technologies (i.e. LEGO ROBOTICS, ROBOLAB® and LEGO® MINDSTORMS software), techniques for developing engineering lessons, and approaches to leading activities with K-12 students. Throughout the year, the STOMP fellows also attend weekly meetings, where STOMP executive board members review specific topics (i.e. State Curriculum Frameworks, Classroom Management Techniques) with the group.

Even with this ongoing support, the STOMP training is not adequate (or intended) to make STOMP fellows capable of leading a classroom on their own. The partner teacher plays an important role in STOMP experience and replicating the teacher's strengths would be a waste of resources. Instead, the STOMP fellow learns to support the teacher with engineering content knowledge while allowing the teacher to support the STOMP fellow with classroom management skills and instructional techniques.

1.4 How does STOMP work?

The exact details of the STOMP program logistics are described in the next section of this document. In general, STOMP fellows meet with teachers to decide upon a set of activities that encompass the goals of both parties at the beginning of the school year. The fellows and teacher review their respective roles in the classroom, schedule times to meet, and make all other necessary plans prior to program initiation. During the STOMP sessions, fellows then bring materials into the classroom (if necessary) and assist the teachers with hands-on engineering activities. The duration of the partnership may vary, but the eventual goal of the STOMP program is for the partner teachers to take on greater responsibility in the integration of engineering concepts in the classroom.

1.5 What does a STOMP curriculum entail?

STOMP fellows have access to a number of engineering lessons developed by previous fellows. These activities will usually form the core of the curriculum planned for the outreach experience. If a teacher has specific goals for the class, STOMP fellows are willing to work with the teacher to modify pre-existing activities or develop new ones. The curriculum is intended to support both the interests of the STOMP fellows and the partner classroom. In general, the STOMP curriculum is a combination of previously created activities, lessons customized for a specific topic, and new activities that address a suggested concept.

The STOMP curriculum will typically begin with a few introductory lessons that familiarize the class with the engineering design process and the technologies that will be used in the classroom. After this introductory period, the STOMP fellows will implement the curriculum developed in consultation with the partner teacher. These lessons usually consist of hands-on building or programming activities that revolve around a common theme or goal, with each activity exploring a different facet of engineering. Some of the lessons also include opportunities for students to document their work or reflect on the engineering concepts discussed in the day's activity. The curriculum typically concludes with a final project as closure to the experience. Students utilize the knowledge and techniques accumulated during the previous lessons to address this larger task.

1.6 What characterizes individual classroom sessions?

Generally, STOMP classroom sessions last one class period or about 60 minutes. The exact session schedule with vary with the material being presented, but will usually involve a brief introduction, work time, and a wrap-up period.

**Introduction* - The STOMP fellows will review previous engineering activities, describe the session's challenge, and establish a schedule with the class. The introduction period often includes an activity hook (i.e. a movie, background information, or a real-world example) to help excite the students about the activity.

**Work Time* - The work time gives students the opportunity to work on the engineering problem as a group, in partners, or individually. Students are typically building and testing solutions during the work time, but may also receive direct instruction regarding a building or programming technique.

**Wrap-Up Period* – Depending on the type of session, students may either present their design solution or update the class on their project status. During this wrap-up period, students recount challenges and difficulties that they encountered, strategies they used to overcome them, and explore the context of the activity with the STOMP fellows.

1.7 What is the STOMP approach to the classroom?

Engineering is the fundamental component in all STOMP curricula. Engineering is often described as a real-world application of science and math concepts. In that way, engineering activities often differs from some traditional math and science environments in that engineering problems do not have a single "correct" answer. Instead, students develop techniques for defining problems, designing solutions, evaluating those solutions, and redesigning their projects. Engineering curriculum places an emphasis on the process, rather than the product, of translating math/science facts into real-world applications. As such, the STOMP approach to the classroom involves hands-on problem solving and lessons where students work cooperative to address design challenges.

1.8 What type of environment is fostered in a STOMP classroom?

For many students, the STOMP experience is significantly different than other classroom activities. In a successful STOMP program, the learning environment is marked by the following characteristics:

- **No perfect answer:** In engineering, there are always multiple ways to define a problem and multiple solutions to each problem. Students are encouraged to discuss how one solution may accomplish the goal more or less effectively than the other.

- **Sharing of ideas.** Collaboration is an important aspect of engineering. While students typically view sharing answers as "cheating" or "copying", the idea of sharing strategies is strongly encouraged in an engineering environment.
- **Encouragement to fail and redesign:** In both engineering curriculum and the engineering industry, the first solution to a design challenge rarely works perfectly. Failure is understood to be an important and necessary part of the engineering design process; failure also indicates that a student is willing to take risks. Rather than dwelling on a failure, the STOMP classroom focuses on assessing the flaws in the design and developing a redesign that will address those issues.
- **Teachers without answers:** With open-ended challenges, teachers will rarely be able to answer all student questions. Instead, students will be encouraged to solve their own problems, with teacher offering guidance or advice about general engineering techniques.
- **Student Experts:** As students develop innovative solution, the STOMP fellows will often make them the "expert" at that topic. The class learns to rely on each other for answers, rather than always turning to an adult for solutions.

2.0 Phases of STOMP Implementation

The implementation of STOMP is a coordinated effort between the Tufts University students and their partnering classroom teachers. The relationship between teachers and fellows varies from classroom to classroom along a continuum that depends on a number of factors. These factors include:

a.) The logistics of the classroom.

b.) The teacher/fellow levels of experience.

c.) The classroom's specific goals.

While the teacher/fellow relationship is both variable and dynamic, there are three general models of this partnership in a given classroom. While commitments to specific classrooms are made on a semester-by-semester basis, classrooms progress along the continuum from Phase I to Phase III throughout the course of involvement with STOMP. Please refer to Appendix B for a schematic of the three models.

2.1 Phase I – New Teacher

Phase I of the STOMP program is usually for those teachers new to the outreach program. The teacher has little to no experience with engineering education, but is enthusiastic about learning and implementation

TEACHER ROLE	FELLOW ROLE
• Assists with curriculum design and day-to-day activities by providing input on content areas, standards and classroom goals • Active observer in classroom, asks questions, supports and provides feedback to fellows • Develops engineering education strategies and becomes more comfortable with technology and engineering • Management of logistical, discipline, and behavioral issues	• Leads curriculum design process, helps choose and lead classroom activities • Provides materials and technological expertise • Maintains frequent communication with teacher

PHASE I Example:

Erin and Sam are two STOMP fellows with multiple years of experience in the classroom and planning curriculum. This semester they are placed in Ms. Beach's 5th grade classroom. Ms. Beach has attended a CEEO workshop on LEGO robotics but has never developed an engineering curriculum and still doesn't feel very comfortable with ROBOLAB. Before getting started in the classroom, Ms. Beach meets with Erin and Sam to discuss her goals for the engineering unit. Erin and Sam meet during the following week to outline a curriculum designed around Ms. Beach's goals. During the 8 week program, the fellows introduce and lead the activities, while Ms. Beach asks the students questions, performs assessments, assists the students, and manages behavioral and disciplinary issues. Throughout the program, Ms. Beach asks Erin and Sam questions to learn more about the engineering unit (building and programming) so that she will feel confident to teach it alone the following year.

2.2 Phase II – Novice Teacher

Phase II of the STOMP program involves teachers already familiar with the STOMP program and goals. Some teachers involved in Phase II worked as engineers before returning to the K-12 classroom. Other Phase II teacher taught with STOMP mentors in previous academic years or attended CEEO workshops during the summer.

TEACHER ROLE	FELLOW ROLE
• Collaborates with fellows to develop curriculum and organize classroom activities • Co-leads classroom activities with fellows • Interactive feedback process with fellows – active communication • Continues to develop engineering education teaching techniques and familiarity with technologies • Management of logistical, discipline, and behavioral issues	• Assists with curriculum design, shares classroom activity leadership with teacher • Provides materials and technical support • Works with teacher to develop sustainable technology and engineering skills

Phase II Example:

Kyle and Tom are two STOMP fellows with different classroom and ROBOLAB experience. This semester they are in Mr. Brown's 4th-grade classroom with over 30 students. Mr. Brown has been to the summer training session and did some LEGO activities last year. Before going into the classroom, Kyle and Tom meet with Mr. Brown to develop a curriculum unit. Mr. Brown has done some simple machines activities over the past year so Kyle and Tom decide to expand the activities to a full simple machines curriculum. Kyle and Tom work with Mr. Brown to create a curriculum that will fit his students' ability levels. Each week in the classroom, Kyle, Tom, and Mr. Brown take turns introducing and leading the activities. Kyle and Tom make sure that there are enough supplies and that ROBOLAB is working, and Mr. Brown makes sure there are no discipline problems and completes assessments of the students on a monthly basis. Kyle, Tom, and Mr. Brown ask the students questions and help the students build their creations.

2.3 Phase III – Experienced Teacher

Phase III of the STOMP program is for teachers actively involved in the engineering education for multiple years. These teachers have already demonstrated an ability to incorporate engineering curricula into classroom with little support from fellows

TEACHER ROLE	FELLOWS ROLES
• Leads curriculum development and classroom activities • Management of logistical, discipline, and behavioral issues	• Provides input and support to teacher during curriculum design process and classroom activities • Links teacher with engineering education resources and training opportunities • Offers feedback to and communicates with teacher • Technical support when needed

Phase III Example:

Miranda and Kate are two first-year STOMP fellows. Although both have prior experience with children, neither has spent much time planning curriculum or being in a classroom setting. They are working in a 2nd-grade classroom with Mr. Paulson this semester. Mr. Paulson has been implementing an engineering curriculum in his classroom for over 5 years, but he often finds it hard to give enough attention to a class full of 9 year olds with LEGOS. Miranda and Kate go to his classroom each week to help the students with building their projects and to provide extra materials. Mr. Paulson introduces and leads the activity as well as assesses each student's progress and manages the behavioral problems. Throughout the course of the semester, Miranda and Kate offer helpful advice on improvements to the curriculum.

3.0 Getting Started

Once STOMP fellows are placed with a classroom teacher for a given semester, the teacher will be contacted in order to set up a meeting schedule with the STOMP fellow. Typically, there are three formal meetings between the STOMP fellow and the teacher during the course of the STOMP program.

- ***1st Meeting****:* Setup before start of the engineering classes, this initial meeting provides the opportunity for the teacher to meet the STOMP Fellow. This meeting is also used to describe the classroom and the goals for the year.

- ***2nd Meeting****:* Midway through the mentorship, meet with STOMP fellow to discuss how the class has gone and what changes (if any) should be made.

- ***3rd Meeting*****:** As you finish the outreach experience, schedule a debriefing with your STOMP fellow to describe what worked during the year, what needs improvement, and what components of the engineering curriculum were especially powerful.

Of all the meetings, the initial meeting between the STOMP fellow and the teacher sets the tone for the rest of the outreach experience. The STOMP fellow will likely arrive with many questions about your school, classroom, and your particular approach to education. At this initial meeting, the teacher should be prepared with:

1. A basic understanding of how STOMP works and what is entailed
2. Any requirements that the school has for background (CORI) checks or other security procedures
3. Ideas for curriculum development:
    a. Classroom math and science topics
    b. Curriculum standards or goals
    c. Specific requirements for the program (writing component, inclusion of specific content, general concepts to incorporate)
4. Information about the classroom:
    a. List of students
    b. Number of computers and Operating System
    c. Storage space

   d. Workspace
   e. LEGO material availability (and how many kits you have)
5. Classroom meeting time and place (including school vacation dates)
6. Classroom rules and discipline procedures
   a. How to get the students attention and how to deal with a noisy classroom
   b. Suggestions for how students share their work in your classroom
   c. Bathroom procedures
7. Any other specific details fellows should know about
   a. How long direct instruction (lecturing) should be
   b. Students with special needs
   c. Classroom rituals
8. Excitement and willingness to learn and be involved with engineering education in the classroom!

3.1 Classroom Sessions

In addition, teachers must be prepared to devote significant time (at least 1 hour) to meeting with fellows to discuss curriculum plans and classroom procedures. Teachers are expected to actively participate in the day-to-day STOMP activities. The following are a few suggestions for teacher involvement especially for teachers new to STOMP:

1. Complete the day's activities with the students to become more familiar with the engineering design process and the technologies in use.
2. Ask the students lots of questions – What have you built? How could you make it better? What do you need to change in order to pass the test? Can you explain to me how that works?
3. Feel free to refer questions or building issues to STOMP fellows in the beginning, but take note of their responses and actively build engineering experience.
4. Get involved in the testing process – carry a clipboard and determine who has passed daily challenges/achievements.
5. Get involved in the end of class discussion. Make sure that you are connecting what the students are learning during the engineering session to what they are learning in other subjects – math, science, writing, etc.

Teachers are a critically important part of the Student TEACHER Outreach Mentorship Program. Their expertise and enthusiasm in the classroom is greatly valued, and their involvement in the planning and day-to-day implementation of STOMP is the key to its success.

4.0 Frequently Asked Questions

What to do if:

1. **School is cancelled?**

   If school is cancelled, email or phone the STOMP fellows to let them know as soon as possible. At the beginning of the semester, it's best to let STOMP fellows know how your school publicizes cancellations. Also, be sure to tell the STOMP fellows of planned vacation days while deciding on the curriculum.

   If you miss a STOMP session due to a snow day, try to reschedule with your STOMP fellows; however, remember that engineering students at Tufts University are typically taking 5 classes each semester so unfortunately rescheduling may not be possible.

2. **You have a problem with the fellows?**

   The STOMP at Tufts carefully trains and screens the students who become fellows. We make every effort to make sure they are prepared to be positive, responsible role models in a K-12 classroom. However, it is possible that you may have a problem with a STOMP fellow. Please feel free to directly address the issue with the fellow in a professional manner. If you do not feel comfortable addressing the issue or you and the fellow are unable to resolve the issue please contact Adam Carberry the STOMP program manger by e-mail (adam.carberry@tufts.edu) or phone (617-627-5888).

3. **Someone else is in the computer lab during your assigned time?**

   If you know you will not have the computer lab ahead of time, let the STOMP fellows know as soon as possible. Also, plan a backup activity with your STOMP fellows that does not involve programming so that there is always something for the students to do.

4. **You have a substitute teaching your class?**

   When planning for the semester, please let the STOMP fellow know if there are any days you are planning to be out of school so that they will be prepared. If you have an unexpected absence and are able to let the STOMP fellow know by e-mail or phone, it is greatly appreciated. You and your STOMP fellow should discuss contingency plans for your unexpected absence. In many cases (particularly a very active class), the classroom teacher is essential to the success of a hands-on activity. The

fellow and the teacher might want to plan for a video or a writing activity if the teacher is unexpectedly absent.

5. Can I grade papers while the STOMP fellows are here?

STOMP fellows are not trained educators and are not prepared to take over your classroom. It is essential that the teacher is a full participant in the engineering session. STOMP fellows are there to assist in teaching the activities, provide materials, answer engineering questions, and provide positive role models. Refer to teacher/fellow responsibilities pages 5-7 for more information.

6. What if I don't feel comfortable with the engineering material?

Don't worry! Many teachers feel uncomfortable with engineering curriculum as engineering is often not a part of teacher preparation courses. Initially, let the STOMP fellows take the lead in presenting the engineering material. The teacher can provide essential support to the STOMP fellows in the form of classroom management and general instructional techniques. As the outreach program continues, the teacher will learn about the engineering curriculum along with the students. If the teacher still feels uncomfortable with the engineering curriculum, speak to the STOMP fellows about opportunities to explore the topic in more detail.

How do I learn more?

Visit our website at www.stompnetwork.org

5.0 Web Resources

STOMP Resources

www.stompnetwork.org/tufts
The Tufts University STOMP site features information about the STOMP program and fellows.

www.ceeo.tufts.edu
The Tufts University Center for Engineering Educational Outreach home page allows you to download useful activities and view our latest workshop offerings.

Curriculum Resources

www.LEGOEngineering.com
Tufts Center for Engineering Educational Outreach and LEGO Education together produce LEGOEngineering.com. The site provides resources for educators teaching with LEGO materials. The site features content for the RCX, NXT, ROBOLAB software and NXT-G.

http://www.engineeringk12.org/
The American Society for Engineering Education's K-12 page features information for educators interested in introducing engineering in their classrooms.

http://teachengineering.org/
Sponsored by the National Science Foundation, Teachengineering.org features curriculum and resources for introducing engineering in K-12 classrooms

LEGO Resources

http://www.legoeducation.com/
This site has activities and information about the LEGO Mindstorms products. This website is also the place to purchase kits and extra pieces from LEGO education.

http://www.lugnet.com/
LEGO Users Group Network is a great community site with forums and product information.

http://www.nxtasy.org/
NXTasy.org features a blog, forums, and repository of code and other tools for the NXT.

http://thenxtstep.blogspot.com/
The NXT STEP Blog brings together news and information related to the LEGO Mindstorms NXT system.

http://www.mindsensors.com/
Mindsensors.com is the place to find third party sensors and accessories for the NXT and RCX.

http://www.hitechnic.com/

HiTechnic Products produces sensors, controllers and other accessories for LEGO MindStorms robotic systems.

6.0 Important Contact Information

CEEO Contact Information
Center for Engineering Educational Outreach
474 Boston Ave
Curtis Hall Basement, Tufts University
Medford, MA 02155
Phone: 617-627-5888
Fax: 617-627-4760

STOMP Program Manager
Adam Carberry
Adam.carberry@tufts.edu

Assistant Director of the CEEO
Melissa Pickering
Melissa.pickering@tufts.edu

STOMP Fellows contact information:

Fellow: _____

Email: _____

Fellow: _____

Email: _____

STOMP Checklist – Classroom Program

SECTION 1: Prior to Meeting with Your STOMP fellow

☐ Schedule a day and time to have students in your classroom

☐ Inform the STOMP Program Manager if the students need to have a background check before being in your classroom

☐ Give the STOMP fellows check-in/security procedures

SECTION 2: Meeting with Your STOMP fellow

DETAILS:

☐ Confirm the time, dates, and the number of sessions that you will be working with the STOMP program (make sure to confirm school vacations)

☐ Give the STOMP fellows a class list

☐ Tell the fellows how many students are in your classroom and grade level.

☐ Find a place for the students to build and test their projects

☐ Find a space to store projects between sessions

☐ Let the STOMP fellows know what materials are needed and what materials are already in the classroom (kits, arts and crafts, etc.)?

CLASSROOM:

1. Are there any issues about the students that the STOMP fellows should know ahead of time (special needs, discipline problems, bilingual students, etc.)

   _____

   _____

   _____

   _____

2. Determine your role in the classroom. Will you be teaching the class with the STOMP fellows as an aide or will the STOMP fellows present the material and you will do the assessment?

3. Let the STOMP fellows know how you deal with classroom management. Are there rules that the STOMP fellows should be aware of?

4. How will the lessons be incorporated into the classroom? Will it be taught as part of a class, as an elective, or by another means?

5. Will there be additional help in the classroom (aides, parent volunteers)?

CURRICULUM:

1. What engineering curriculum standards do you hope to address through these sessions?

2. Determine if/how to incorporate interdisciplinary activities (i.e. Is there a particular subject being taught in the classroom that you would like to incorporate into engineering sessions?)

   _____

   _____

   _____

   _____

3. How will the students be assessed? Will the STOMP fellows be involved in this assessment?

   _____

   _____

   _____

   _____

If Robolab is being taught in the classroom:

1. Have the students been exposed to Robolab or LEGOs in the classroom? If they have, what have they been taught?

   _____

   _____

   _____

   _____

2. Will there be computers available? _____
3. Can you install ROBOLAB on to the computers (this requires Windows XP or later and 128 MB of RAM)? – this must be done prior to your first session

   _____

4. Are there any security settings on the computers that might interfere with ROBOLAB?

   _____

   _____

5. Do the computers have USB ports for towers?

   _____

6. If the computers are laptops, are there mice available for the students to use?

   _____