S.T.O.M.P.

STUDENT TEACHER OUTREACH MENTORSHIP PROGRAM

FELLOW MANUAL

Draft Version 2.8 (9/2005)

http://www.ceeo.tufts.edu/stomp

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1 Engineering Education in the Classroom

1.1 Introduction: Why Engineering Education?

Engineering exists at the baseline of our daily lives. Products ranging from computer chips to helicopters to cereal are all designed, manufactured, and/or packaged by engineers. At young ages, children insist on understanding, changing and improving phenomena around them, yet their intense curiosity tends to fade with age. Introducing engineering in the classroom helps to rekindle this curiosity and fosters an engineering mindset.

Primarily focused on problem solving, engineering simultaneously demands analytical and creative thinking. A K-12 curriculum that incorporates an engineering component diversifies lessons and demonstrates life applications of math and science concepts. For example, a math unit on fractions can be taught with gear ratios, which subsequently relates to the workings of vehicles and bicycles. This hands-on gear lesson provides applicable knowledge of fractions and relates engineering to the students' level of understanding.

1.2 The Problem: Unfamiliarity with Engineering

Successfully integrating engineering in a K-12 curriculum requires additional time, effort, and flexibility from the educator. Teachers are generally unfamiliar with engineering, and thus are intimidated by the technical field. In addition, teachers are under pressure by the school system to abide by curriculum standards to prepare their students for standardized tests. These factors inhibit K-12 integration of engineering, and explain why students may go through school without any conception of the engineering discipline.

1.3 The Solution: Tap into University Resources

College students are ideal resources for the K-12 educators. These students are active in engineering and research on a daily basis, and thus are freshly knowledgeable with engineering concepts. The Student Teacher Outreach and Mentorship Program (STOMP), places college students in the role of outreach fellow and pairs them with K-12 teachers. The fellow-teacher team collaborates to develop and implement interactive engineering lessons. The following guide outlines the steps to establish and operate this outreach program at any university around the country.

1.4 The Components of STOMP

1.4.1 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. The fellow's role is to enhance the engineering knowledge of both the teacher and children. This includes developing curriculum with hands-on activities, creating resource materials, and providing assistance in the classroom. In turn, the responsibilities of the teacher include helping the student become familiar with working in a classroom setting, developing engineering units that interweave existing units, and gaining self-sufficiency for teaching engineering in the future. Once the fellow leaves, the teacher will have a library of engineering-based activities and confidence to implement them in the future. The fellow, on the other hand, gains an awareness of the education system, enhanced communication and leadership skills, and enough confidence in the classroom environment to continue outreach post-graduation.

1.4.2 The 'O-M-P' in STOMP: Outreach and Mentorship Program

The outreach program is particularly important for providing assistance to underrepresented students and females. In the past, engineering has been a male-dominated field, partly because girls tend to avoid the typical boy play of building models and taking apart toys. To accommodate these gender differences, yet still spark an engineering interest in girls, the program emphasizes gender-neutral activities therefore introducing engineering to everyone. In addition, it is important for the university to support underprivileged schools in inner-city settings to present engineering as an attainable goal. Children look up to the older students, and when their mentor is studying engineering, they realize that they can follow suit and the engineering field becomes a more realistic goal for them.

2 Implementation of S.T.O.M.P.

2.1 Getting Started with the Teacher

This section covers the following topics:

- Classroom preparation checklist
- Classroom dynamics and setting standards
- Establishing the role between teacher and fellow
  - →Case Studies

2.1.1 Establishing Fellow/Teacher Role

A STOMP fellow must determine whether he/she will be the actual teacher during engineering class or simply act as an aide. The role is unique to the classroom setting and teacher's experience. Below are two examples of STOMP supported classrooms that established different roles between the fellow and teacher. The first case demonstrates a classroom environment where the fellow takes on more of a supporting role, and the second case represents a fellow as the teacher.

2.1.2 Classroom Checklist

Whether supporting an after school program or entering a regular classroom, planning is a very important component. This checklist assists STOMP fellows when first meeting with the teacher to establish respective roles and a realistic timeline. Part of planning activities should involve coordinating the units in the classroom with the state standards. In addition, details such as begin/end dates, holidays, absences, book fairs, field trips, etc need to be covered at the very beginning so as to avoid miscommunication and frustrations later. Commitment from both sides (teacher and fellow) is absolutely necessary. A basic overview of the checklist (see expanded version in appendix) is below:

- Schedule a time with the teacher to work in the classroom
- Get clear directions and determine how long travel time will be

- Develop curriculum for your classroom
- Determine a final project or culminating event
- Determine the materials and computer equipment necessary

2.1.3 Classroom Dynamics and Setting Standards

Each school will have unique demographics, and it is important for the fellow to become familiar with the ways of the school. For example, STOMP fellows at Tufts support Chinatown classrooms, a school with an open classroom environment. There are no separate classrooms with walls and doors; the classes branch from an open hallway and are separated by room dividers. As can be imagined, sound travels very easily from classroom to classroom and potentially noisy hands-on activities disturb other classrooms. This is something that the STOMP fellows should be aware of and accommodate activities accordingly. Mention technology, student diversity issues, other “dynamics” issues.

CASE STUDIES: Fellow -Teacher Interactions

1. Case Study: Eliot-Pearson Children's School, Tufts University
2. Case Study: St. Joseph's, Medford, MA

1. STOMP Fellow as a Supporting Instructor

Case Study: Eliot-Pearson Children's School, Tufts University

At the Eliot-Pearson Children's School, an engineering unit was introduced to a first and second grade classroom using Legos and Robolab. Two STOMP fellows worked in the classroom as aides to the teacher. Before the STOMP fellows began in the classroom, the fellows and the teacher met to discuss the curriculum that had previously been developed by the teacher. The fellows went over the curriculum with the teacher and suggested other options for activities and discussed the length of time needed for each lesson.

For each lesson, the STOMP fellows would set up the classroom with all the computers and the Legos. The teacher would introduce the lessons and describe the challenges. As supporting instructors in the classroom, the fellows' role was to help set up the classroom, answer individual student questions, and to fix any problems that might arise with the Robolab. The STOMP fellows' goals were to make the lessons go smoothly and to provide an extra hand in the classroom.

2. STOMP Fellow as an Instructor

Case Study: St. Joseph's School (Medford)

For St. Joseph's School, the STOMP fellow designed an environmental unit to be implemented in a seventh grade classroom. The STOMP fellow designed the curriculum and then reviewed it with the teacher to discuss how to tie what the teacher was currently teaching with the Lego curriculum. In the classroom, the fellow was responsible for introducing the topics and providing instructions for the activity. Most of the discipline problems were addressed by the teacher. The teacher also helped by roaming around the classroom to answer additional questions. Assessment of the students' work was performed by the teacher. As the main teacher, the fellow is responsible for developing the curriculum (although input from the teacher is important), setting up the classroom, and teaching the lessons. For STOMP, the goal is that the teachers will slowly begin to teach more of the lessons and the STOMP fellows will begin to take on a more supporting role as described above.

2.2 Designing Curriculum

Creating curriculum is an iterative process, as activities will most likely be modified during and/or after implementation depending on what is successful.

- Education Standards and Design Process
- How to Design Curriculum (General and Detailed)
  - →Case Studies

2.2.1 Education Standards and Design Process

Before designing curriculum, it is important for STOMP fellows to understand the curriculum standards outlined for the appropriate grade level, and subsequently highlight those concepts in the classroom projects. National organizations such as the International Technology Education Association (ITEA, http://www.iteawww.org/TAA/TAA.html), American Association for the Advancement of Science (AAAS, http://www.project2061.org/publications/bsl/default.htm) and the National Council of Teachers of Mathematics (NCTM, http://www.nctm.org/standards/) have developed standards to address important curriculum topics.

Although the standards vary by grade level and subject, one concept that is consistent for all ages with regards to engineering and technology is the engineering design process. The classroom projects are executed following this process, so that the students develop the habit of:

(1) Identifying the problem/task;
(2) Outlining/designing the solution on paper;
(3) Constructing and testing the solution;
(4) Analyzing the results of the tests;
(5) Discussing how to make improvements for future designs;
(6) Redesigning the solution (if possible).

The design process helps students (and teachers) to gain an understanding of how ideas are developed into products and manufactured. Design is often a good way to tie together seemingly unrelated technology lessons or to create interdisciplinary projects. Using the design process to structure lessons – covering only one or two steps during a session –can provide opportunities to build in multiple layers of assessment during planning, prototype evaluation, and redesign.

In addition to these design process standards, each school has its respective state curriculum frameworks, which the fellow should become familiar with. Curriculum may be developed to target each standard individually, or satisfy several standards at once. Fellows should work with their teachers to understand what is already being done to meet the standards and what standards the teacher hopes to address during lessons with the fellow.

2.2.2 How to Design Curriculum: General Overview

- Familiarize yourself with the current grade level curriculum standards
- Familiarize yourself with model units already being taught by other outreach programs
- Identify 2-3 engineering standards to synthesize into a hands on activity
- Relate the activities to an existing learning unit
- Break the activity into steps along a timeline:

1. **Introduction**: --mention how u should catch interest
   --How the activity fits into big picture;
   --What will we learn;
   --What is the final goal;
   Time: *1 Session*

2. **Activity:** --Brainstorm solutions;
   --Create the solutions;
   --Testing and redesigning
   Time: *2 Sessions*

3. **Conclusion:** --Hold a final competition
   --Discuss successful solutions
   --Reflection: What did we learn?
   Time: *3 sessions*

- Brainstorm activity extensions in anticipation of fast learners, or ways to shave off time if it runs out

- Assess the activity (rubric)

See Appendix for an example of a layout for curriculum.

<u>How to Design Curriculum:</u> In Detail:

A. Identify Goal for the Class
B. Identify Working Timeline
C. Establish an Activity
D. Prototype & Create Support Materials

A. Identify Goal for the Class

Create a goal that satisfies an engineering standard, interweaves existing curricula, and provides a tangible measure of accomplishment. Instead of setting a broad goal that encompasses a range of projects, the teacher and fellow should create a specific goal so that activities may be more easily developed. For example, in a third grade classroom supported by STOMP, the fellow and teacher established a goal to introduce planet orbits and rotation with Lego vehicles. This specific goal tied into the solar system unit, and also introduced the engineering design process with vehicle construction.

While goals may initially be specific, the teacher and fellow will discover that hands-on engineering activities tend to address a number of concepts. It is important to address the majority of these concepts in the lesson, without overwhelming the class. In the above mentioned solar system activity, there are endless design issues involved in constructing a Lego vehicle. From wheel size to gearing to structure, it would be easy to overload the class with information. The third graders should be introduced to these concepts, yet expected only to understand the range of factors equivalent with their previous knowledge. It would be too much to expect the class to immediately comprehend each concept; however, with subsequent activities, the children will gradually become more familiar with more specific engineering concepts.

B. Identify Working Timeline

Develop a rough timeline that estimates the number of classroom hours to be spent on each activity. This will ensure that goals are accomplished, as it is often easy to spend more time than necessary on a project. Two timelines should be constructed: a general timeline setting weekly schedules, and then a more detailed timeline outlining daily sessions. While a rigid schedule is not needed, it is important to gain a general concept of time. The hands-on activities are fun for the children, but they tend to wander off-task with their own project extensions. While this creativity is applauded to an extent, this is an appropriate time for the teacher to introduce realistic deadlines and time restrictions.

Once the fellow is in the classroom, he/she should take into consideration setting mini-goals for each student by the end of the class. The easiest way to accomplish this is by constructing an activity so that it can be divided into multiple sections that can each be tested individually. This way, each time the fellow enters the classroom, he/she can explain what needs to be accomplished by the end of the class. Often this can be a challenge when working in a classroom that has many different levels of students or a classroom in which the students are working on different projects. To accommodate for this type of situation, fellows have found an easy way to keep the students on task is to go around the classroom at the beginning of the day with post-it notes and ask each student individually what they would like to accomplish for that day. In this manner, by the end of each class, the student will know whether he/she is on track or not.

C. Establish an Activity

Upon identifying a goal and the time available, the next step for the STOMP fellow and teacher is to decide on an appropriate activity. In order to accomplish the goal, and ensure that the children actually gain knowledge from a project, it is suggested that an activity lasts two to three class periods. An activity that lasts too long should be avoided because the class will likely lose interest. All activities should involve an introductory discussion, a building period, a testing period, and a final discussion. There are a number of engineering units available on the internet, and these activities can be taken and implemented as they are, or adjusted to fit the unique goal and timeline. (put in website links??? Refer to case study???) Developing activities is the most time-consuming aspect to establishing an engineering curriculum, yet may be a fun way for the teacher and fellow to exercise creativity.

D. Prototype & Create Support Materials

A key step in the engineering design process is the construction of a prototype. This allows engineers to evaluate the design of the product, perform tests, and subsequently redesign to accommodate for the failures that occur. Similarly, it is important for the STOMP fellow and teacher to run through each project prior to implementation in the classroom. In doing so, they can troubleshoot outside of the classroom so that execution of the project will run more smoothly in class. Of course, not all projects require this prototyping step, but at the least, a brief discussion on how the actual project will be run in class is necessary. The fellow and teacher can divide tasks among each other, such as creating extra handout sheets and project extensions. Hands-on projects can become hectic and frustrating with increased noise, excitement, and questioning. By mentally or physically executing the project before class, the teacher and fellow will be prepared for potential mishaps.

CASE STUDIES: Integration of Engineering into Curriculum

1. Case Study : Lincoln School, 4th grade, Lincoln
2. Case Study: Lincoln School, 3rd grade, Lincoln

1. Egyptians as Engineers, Grade 4

Two STOMP fellows collaborated with two fourth grade teachers to develop a project on pyramid construction, thus interweaving the Ancient Egypt unit with engineering principles. The project consisted of two challenges and was executed in four one-hour sessions. Each group was challenged to build a Lego vehicle powerful enough to drive up an inclined plane and pull a weighted sled. While this simulated the process of hauling stones up a pyramid side, the kids simultaneously learned about gears, friction, and forces. Prior to execution of the activity in the classroom, however, the STOMP fellows built a vehicle and sled themselves and determined the appropriate angle to set the inclined plane. In addition, the STOMP fellows determined the characteristics that the vehicle and sled needed in order to summit the 'pyramid'. When it was time to implement the activity in class, the fellows were prepared to guide the class in the direction of functioning vehicles.

2. Solar Systems, Grade 3

Integrating engineering into the existing curriculum is important to creating a well-rounded unit. A third grade class studied the solar system in their social studies unit, therefore the teacher and STOMP fellow created an engineering unit based around the solar system. Instead of making the traditional diagrams of the solar system, the children were able to physically create a planet using Lego pieces and then program their planet to travel around the sun in its orbit. This activity demonstrated the difference between rotation and revolution, as well as the varying speeds of planets traveling in their orbits. The engineering concepts addressed were programming techniques with RoboLab and the construction of a remotely operated vehicle to follow a path. Refer to the Appendix to view the associated support materials for this activity.

It was relatively easy to integrate the solar system unit with engineering, but it is also possible to interweave engineering into a literature unit. The same third grade class read The Magic School Bus Travels Inside the Earth, and the teacher and STOMP student based the next engineering activity around this book. The activity included a three-part model of the earth with various obstacles representing each layer. The class was challenged to create a Lego vehicle capable of retrieving a magnet from the iron core, pushing aside packing peanuts within the semi-solid mantel, and traversing bubble wrap as the rocky crust. This obstacle course simulated the barriers that Ms. Frizzle and the students on the school bus had to overcome in the book. One of the benefits to the integration of engineering with unrelated units such as literature is that it allows children who particularly enjoy one subject such as reading to then develop an interest in engineering, and vice versa. These students will consequently realize the connection of different disciplines. Integrating

2.3 Education Techniques in the Classroom – Hints for a successful program

This section details successful teaching techniques when implementing activities:

- Asking Questions
- Setting Goals
- Identifying Constraints
- Problem Solving
- Troubleshooting
- Final Competition

→Case Studies

2.3.1 Asking Questions

The most effective method of conveying the exciting opportunities within the engineering field is to emulate real engineering projects. Typical lecture and worksheet time in the classroom should be kept to a minimum. However, to ensure that the class grasps the key concepts, each project should be formally introduced. Before the start of a project, pique the children's curiosity with questions, and relate the project to familiar phenomena in their lives. For example, to steer the class in the direction of creating a suitable sled in the Egyptian engineering unit, the children were asked to think of a snow toboggan, and thus were able to identify an ideal sled as possessing two runners. The relation of this familiar toy helped the students understand and discover the project solution.

2.3.2 Setting Goals

After grasping the children's attention with the project introduction, the next step is to outline a schedule for them to follow. For each activity, allow enough time for the students to exercise creativity, and explore and learn from their own tangents. At the same time, provide deadlines for milestones throughout the activity; otherwise the students, similar to engineers in industry, will tend to redesign and modify repeatedly until the time limit is reached and partially completed projects may result. If the students are aware of time constraints, they will also develop reasoning skills in evaluating the feasibility of their desired solution.

2.3.3 Identifying Constraints

Engineers continually face constraints, thus developing acute problem solving skills. To sharpen children's problem solving skills, the STOMP fellow and teacher should develop activities with a fair amount of constraints, and use them as discussion topics before and during the activity. The educators should present the constraints, and then ask the class to brainstorm ideas on how to overcome the obstacles. Give an example (like making an egg case that is only so big or using only these materials)…

2.3.4 Problem Solving

There may initially be hesitation at the start of a project, and the teacher and fellow could be showered with questions from students. The students are searching for the "correct" way to build the project simply because they are used to this type of learning system. In engineering, there is more than one "correct" solution to the problem, and students should be encouraged to explore different possibilities. To encourage the students to think on their own, the educator should bounce back the questions. For example, in a fourth grade Chinatown classroom, a student asked how to build a Lego chair. He was able to answer his own question when asked to look at the parts of the chair in which he was sitting. Even though the response for the educator was as simple as pointing out the obvious, this method enhances the children's observational abilities to become more insightful for future projects.

2.3.5 Troubleshooting

Although each child has his/her own style of learning, a generally effective method is through hands-on application of the material. It is suggested to encourage this hands-on learning style with engineering education. If a child is building a Lego vehicle, the educator should demonstrate the construction of separate components, and then set the student on his/her own to integrate it all together. This method of teaching is important because it places responsibility on the student to take initiative by piecing together bits of knowledge to develop a whole solution. The educator should certainly avoid building the entire Lego car for the student and hoping that s/he will learn by watching.

2.3.6 Final Competition

Competitions and rewards are used to encourage participation and effort in a variety of cases. In the classroom there is sometimes a question as to whether or not competitions are appropriate and non-discriminating, especially since girls tend to shy away from contests. Boys, on the other hand, generally thrive on competition and yearn for bigger, faster, and better. The STOMP fellow and teacher should set a final test or competition that the class can design their projects for, but there does not need to be just one winner. The emphasis of the contest should not be placed on a best project per say, and there should be discussion as to *why* particular projects were more successful than others. It is important to choose these competition goals to be gender neutral. For example, simply building a fast car for racing may be biased toward boys; however, building a car that is fast but also can protect "passengers" on impact may address girls' interests.

After the final competition, the teacher and fellow together should also prepare an assessment that can be used to determine how successful the students were in accomplishing their goals. This assessment can be a post-survey type where the students have to answer questions such as what they've learned, or how they completed the project. Another type of final assessment is to have the students present their projects to the class. With this type of evaluation, the student is not only able to express his/her problems and display his/her work to the rest of the class, but the student also gains communication skills necessary to explain his/her project. One important factor of the final assessment is that the student should express whether or not his/her goals were accomplished. Each child should express the knowledge that he/she gained from this project as well as what might have helped them to accomplish his/her goals.

CASE STUDIES: Teaching Techniques:

1. Egg Drop Challenge, Somerville
2. Programming the RCX, Boston

Egg Drop Challenge, Somerville

In an effort to demonstrate the existence of constraints in engineering projects, an egg drop activity was implemented in an after school engineering club for girls in junior high. Limited to a 90-minute time frame, the activity was quickly introduced with a brief discussion of gravity, air resistance, and momentum. Next, each team was provided with 30 straws, a role of Scotch tape, and a raw egg. The girls were challenged to create a protective case around the egg to endure a 10-foot drop without breaking the egg. Many of the groups first responded to the challenge with looks of doubt; however, the fellow's encouragement and assistance with brainstorming persuaded the girls to tackle the challenge. In the final test, one egg out of the seven did not break, and therefore proved to the doubtful girls that there was a viable solution despite the seeming impossibility.

2. Programming the RCX, Boston

One of the major dilemmas that arise when beginning a new project is exciting the students about the project. Opening the unit with an interesting demonstration and involving the students in a mini activity have proven to be successful techniques. For example, in fourth and fifth grade Chinatown classrooms, two STOMP fellows introduced the concept of graphical computer programming with the interactive 'Program Mr. Robo' Game show. The ultimate goal of the project was to program the RCX vehicle to drive forward for a specified distance. One of the STOMP fellows transformed into an awkward robot by placing a robot paper bag mask over his head and asked the students to 'program' him to pick up an item at the other side of the classroom. The 'Robot' was unable to speak or see, and purposely followed each of the student's commands literally, so as to convey the idea that computer programming requires explicit commands. For example, one student commanded 'turn right' and the robot spun clockwise continuously, and so the students immediately realized that they needed to yell 'stop' at some point. The next time that the students had to give the 'turn' command they specified a quantity – time or distance – to turn. The students also realized that if they only commanded the robot to 'go forward' the 'Robot' would eventually run into a desk and thus a much more successful command would be 'go forward three steps.' This allowed the students to practice estimating and creating a plan before arbitrarily yelling commands. Of course the whole activity was entertaining, since a college student wearing a mask was being commanded by giggling 10-year-olds to meander through the classroom. More importantly, by the end of the Mr. Robo Game show, the students understood that in order to successfully program on the computer, they had to explicitly state every navigation detail – including direction, distance, and speed. This mini interactive activity provided an excellent introduction to the graphic computer program of Robolab, which the students were ultimately required to use to program their RCX vehicles.

2.4 Awareness of Program Difficulties

This section covers the following topics:

- Range of Classroom Talent
- Organization of Project Materials
- Sustainability of Engineering Education

2.4.1 The Range of Talent in the Classroom

Conveying engineering concepts to young children is a challenge in itself without the added complexity of classroom diversities. The STOMP fellow may be unfamiliar with handling a classroom, and the teacher needs to provide information regarding the overall abilities of the students and class compatibility. Assigning projects to pairs of students stimulates creativity; however, it is important to assign compatible pairs based on teacher's understanding of the students. A child's individual abilities should be known so that the STOMP fellow can create extensions for the children that will help him/her to excel, and provide additional help to those who may have difficulty staying on task. The teacher and fellow can discuss these details in out-of-class meetings. The case study below describes the methods that a fellow used to accommodate the range of classroom talents.

2.4.2 Organization of Project Materials

Hands-on activities, if not properly organized, can turn into disasters. The outreach program at Tufts uses Legos as tools to introduce engineering in most classrooms. While Legos provide a range of project possibilities and appeal to all ages, they must be properly managed in the classroom. In a fourth grade Boston classroom, each group was provided with personal Lego kits. However, the yearlong Lego engineering unit resulted in some kits with shortage of pieces and some overloaded kits. One of the solutions to this problem is to maintain community Lego piece bins and place each group on separate floor mats. The floor mats not only provide larger building space, but also result in fewer lost pieces. Simple organization details such as these should always be addressed before beginning activities so that there will be fewer headaches experienced by all.

2.4.3 Sustainability of Engineering Education

One of the goals of the STOMP program is to not only familiarize the students with engineering, but also enhance the teacher's technical knowledge. The fellows are only temporary assistance, but should leave behind a permanent influence. The fellows should document project procedures, successful activities, and future project options, as well as create guidebooks for the teachers to reference later. Hands-on activities require more effort for the teacher to implement in class than handing out a basic workbook. Minimizing the work for the teachers is essential for them to continue with engineering projects. A sample packaged unit for a fourth grade Chinatown class in the Appendix provides an example of what the fellow should leave behind with the teacher.

3 Appendix

3.1 STOMP Checklist – Classroom Program

☐ Find a location that is accessible

☐ Schedule a time with teacher to work in the classroom

☐ Get clear directions and determine how long travel time will be

☐ Meet with the teacher prior to the first classroom visit to discuss details

☐ Confirm the time, dates and the number of sessions that you will be working with the teacher for

☐ Find out about school vacations, and inform the teacher of any sessions you will not be able to make.

How many students will there be in the classroom? ________________

What grade level are the students? _____________

Obtain a class list and learn the names of the students before going into the classroom.

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

____

____

____

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?

____

____

Determine your role in the classroom. Will you be an aide to the teacher or will you be directly teaching the class?

____

How does the teacher deal with classroom management? Are there rules that you should be aware of?

____

____

____

What will be the workspace for the students to build and tests their projects?

____

Is there space available so that students can store projects between sessions? -

____

What materials are needed and what materials are already in the classroom? -

____

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

____

What are the teacher's goals for these sessions for what the students will learn?

What standards does the teacher hope to address through these sessions?

How will the students be assessed?

Will you be involved in this assessment?

If teaching Robolab in the classroom:

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

____

____

Will there be computers available or do you need to provide them? ______________

Can you install Robolab on to the computers? __________________________

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

____

Will ROBOLAB run on the computers (at least 128 MB of RAM)?

____

Do the computers have USB or Serial Ports for towers? ______________

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

____

Is there a safe place to store projects in between sessions? _____________

☐ Develop Curriculum for your classroom

Refer to the Curriculum section of the STOMP book for ideas and additional information

Test any new curriculum ideas.

Make sure you can complete (building and programming) all the activities that are part of your curriculum

Determine a final project or culminating event

Determine the materials and computer equipment you will need

3.2 STOMP Checklist – After School Program

☐ Find a location that is accessible

☐ Schedule a time with the director of the program

☐ Get clear directions and determine how long travel time will be

☐ Develop ideas for projects that you will want to work on with the students.

☐ Meet with the director prior to the first session to discuss details

☐ Ask for a list of the students' names. Use this to learn the names of students once you go into the classroom.

Questions to ask:

Confirm the time, dates and the number of sessions that you will be working with the after school program.

Find out about any weeks the program will not be occurring and inform the director of when you will not be available.

How many students will you be working with? ________________

What grade level are the students? _____________

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

____

____

Does the after school program have certain policies to deal with discipline problems?

____

____

____

What are the goals of the after school program? Is there anything specific that the director would like to place emphasis on or include in your sessions?

____

____

What will be the workspace for the students to build and tests their projects?

____

Is there space available so that students can store projects between sessions? -

____

What materials are needed and what materials are already in the classroom? -

____

____

Will there be additional help (high school students, other counselors)?

____

If teaching Robolab:

Have the students been exposed to Robolab or LEGOs before?

____

____

Will there be computers available or do you need to provide them?

____

Can you install Robolab on to the computers?

____

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

____

Will ROBOLAB run on the computers (at least 128 MB of RAM)?

____

Do the computers have USB or Serial Ports for towers? ________________

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

____

Is there a safe place to store projects in between sessions? ______________

☐ Develop Curriculum for your classroom

Refer to the Curriculum section of the STOMP book for ideas and additional information

Test any new curriculum ideas.

Develop a timetable and a session by session out line of what you would like to teach the students

Make sure you can complete (building and programming) all the activities that are part of your curriculum

Determine a final project or culminating event

Determine the materials and computer equipment you will need

3.3 Engineering Activity Curriculum Example

Week 1:

- Introduction to Legos
- Names of pieces
- Naming worksheet

Week 2:

- Back to back partner activity: partners sit back to back, each with the same LEGOs in front of them, one partner builds something and describes it to his partner, his partner has to try and build the same object only from listening to his partner's directions
- Introduce basic engineering concept of design
- Goal: Build a sturdy wall
- Have students design the wall on paper first

Week 3:

- Build sturdy wall
- Have students drop wall from a height of one foot into their boxes, and see how the wall holds up
- If it breaks, have them redesign and rebuild

Week 4:

- Goal: Build a chair
- Again, students must first design the chair on paper
- Test the sturdiness of the chair by dropping it in the box, similar to the wall

Week 5:

- Introduce RCX
- Goal: Build a car with RCX attached
- Students must design on paper first
- Test sturdiness of car by turning on RCX and running program one
- If car falls apart, redesign and rebuild

Week 6

- Continue building and testing car

Week 7

- Introduce Robolab using classroom media projector

- Have students create a very simple program, send it to their RCX, and run it
- Goal: Have students make their cars go a certain distance that is taped out on the floor
- Students should keep a log of how far their car goes each time

Week 8

- Continue with distance challenge
- Once students accomplish goal, have them make their cars go twice the distance

Week 9

- Goal: Have students make their cars go out a certain distance, turn all the way around, and then come back to the where they started
- Students should continue to keep a log

Week 10

- If students have accomplished all the goals, a course can be set up in which they have to program their cars to go through

The fellows wanted to make sure that the students understood the engineering design process. They wanted the students to see the whole process: (1) being presented with an objective, (2) brainstorming ideas, (3) coming up with a design, (4) building, (5) testing, (6) redesigning, and (7) rebuilding. The fellows also wanted to make sure that the students saw that it was important keep a log of each step in the process.

3.4 Terms to know

DOE (Department of Education) –

- The U.S Department of Education (http://www.ed.gov) is responsible for implementing federal education programs (like No Child Left Behind). Unlike many countries the U.S does not have a national curriculum or national standards for education.
- The Massachusetts Department of Education (http://www.doe.mass.edu/) is responsible for all the immediate education issues in a state – from allocating federal funds to teacher certification. The Mass DOE sets the education standards for each content area (called Curriculum Frameworks) and administers the standardized testing (MCAS).

Free or Reduced Lunch – Free or reduced price lunches (and breakfast in some cases) are provided to students whose family is at or below specified income levels. The program (National School Lunch Program) was implemented in 1946 by President Truman to ensure students enrolled in school had sustenance and proper nutrition. It is also used as a measure of the economic status of a school as it is the only piece of income data schools collect. For more information visit the USDA web site on the program (http://www.fns.usda.gov/cnd/Lunch/default.htm)

IEP (Individual Education Plan) – Individual Education Plans are designed for students who have a learning or other disability. These plans allow students with different abilities to have different goals and assessments for their learning outcomes. They also often specify that the student have additional assistance from an aid, therapist, or counselor.

MCAS (Massachusetts Comprehensive Assessment System) – The MCAS tests are given in each content area described by the curriculum frameworks. Students are required to pass the MCAS to advance at certain grade levels and to graduate from high school.

NCLB (No Child Left Behind) – Is a federally mandated program that focuses on

- Stronger Accountability for Results
- More Freedom for States and Communities
- Proven Education Methods
- More Choices for Parents

Schools that receive federal funding have an obligation to meet the requirements of the program that are detailed on the U.S Department of Education web site (http://www.ed.gov/nclb)

NCTM (National Council of Teachers of Mathematics) –NCTM is an organization of mathematics educators. The organization works to advance and support mathematics education. NCTM also has authored national mathematics standards that many states use as a guideline for creating state level math standards. (http://www.nctm.org)

NSTA (National Science Teachers Association) – NSTA is an organization of science educators. The organization works on helping students to excel at science. (http://www.nsta.org)

Portfolio Assessment – Portfolio assessment is an alternative method of evaluating students' progress and learning. Typically, students create portfolios of sample of their work over the course of 1 or multiple years. Portfolio assessment is sometimes used in place of standardized measure but can also be used to supplement other assessment methods.

3.5 CEEO Contact Information

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