

Submission Date	2014-11-10 13:01:40
Title of Grant	Electronics in Engineering
Name(s) of Applicants with Grades/Subjects You Teach	Betsy Giovanardi: MHS Teacher of CAD (Computer Aided Design and Introduction to Engineering), all grades David Carbonneau: MHS Physics Teacher (CP, Honors, & AP), grades 11 & 12
School(s)	Melrose High School
Lead Contact Phone #	781-979-2200 x4164
Lead Contact Email	egiovanardi@melroseschools.com
Describe your grant in one sentence.	Students would be challenged to design and build various electrical circuits through the use of inquiry-based hands-on learning projects to gain an understanding of the essentials of electricity, electrical circuits, and binary code all while working as effective teammates.
What is the outcome you desire?	Students would be challenged to design and build various electrical circuits through the use of inquiry-based hands-on learning projects to gain an understanding of the essentials of electricity, electrical circuits, and binary code all while working as effective teammates.
Which category best describes your grant?	New initiative -- truly new to my school or the Melrose Public Schools district
Describe the new initiative or expansion of on-going program and how it aligns with district goals including Melrose Public Schools Strategic Overview?	<p>The curriculum to be supported by this grant includes both high school Physics and Introduction to Engineering. It takes an inquiry-based approach to learning electricity and electrical circuits, which students often struggle to understand from a textbook but is considered by some to be the most important and widespread technological system today. Because the unit uses an inquiry-based approach with hands-on project-based learning, it aligns well with the strategic planning goal of enabling all learners to be able to reach a high level of content mastery and skill development while providing high-quality content to foster higher-level thinking by relating the content to real-life projects.</p> <p>The various projects that would be made possible by the grant follow the electrical unit of the curriculum called "Engineering The Future," which was developed by the Museum of Science and maps directly to state and national standards. For more info on this, see the last section of the grant, under "What else do you want us to know?"</p> <p>The first part of the electrical unit has students use the grant materials investigate basic circuits to build a scoreboard display and develop binary code sequences for using that scoreboard. The students will work as teams to design and build their own circuit design using a breadboard and associated electrical hardware and then test their binary code against their custom-built scoreboard</p>

circuit.

Next the students are challenged to design and build a circuit to control two mini fans independently. The circuits must turn the fans on and off, reverse their directions, and control their speeds. Again, this design project requires the use of the grant materials.

To be able to accomplish the above-stated design tasks, students must use the grant materials to first explore the components through short exploratory tasks and then apply the knowledge learned to complete the design challenge. During the design challenges, students are not told specifically what the design should look like but instead allowed design freedom to create their own solution that meets the requirements of the assignment.

Describe your plan of action: specific activities and timeline for this grant.

The plan of action is to purchase all of the materials ASAP. Once purchased and kitted, the students in Betsy Giovanardi's new class, Introduction to Engineering, will be the first students to complete the electrical curriculum starting mid-December of this school year. As previously stated, the plan of action, including specific activities, objectives, rubrics, etc are all detailed in the MoS Engineering The Future book, which predicts the number of classes required to cover the content to be between 13-15 classes. David Carbonneau's physics students begin their electricity unit in April.

At the conclusion of the grant, how will the knowledge gained be shared among your colleagues? What, if any, resources will be required to do so?

Betsy Giovanardi & David Carbonneau will meet to collaborate and share lessons learned during common planning time. This will take place between January, when the Engineering class has finished and April when Physics is set to start the unit. Additionally, a binder will be kept in the science department collaboration room to be accessible by the entire department. Lastly, none of the items are consumable so the project can be used for years to come.

What prompted you to apply for this grant?

I applied for the grant due to a desire to impact the students learning in such a way that they will become inspired to pursue a career in technology, especially an engineering discipline. Additionally I have already seen first hand the positive impact on student learning and engagement when they are encouraged to explore a topic using an inquiry- and project-based approach. Because the upcoming unit on electrical engineering and circuits is sometimes a difficult concept for students to grasp, I wanted not only make it easier to learn but perhaps even inspire students to pursue a technology career.

TOTAL FUNDS REQUESTED (\$)

\$481

Budget breakdown

Item Description	Price Each	Quantity	Total Price including tax & shipping
wire strippers	\$13.98	1	\$14.89
soldering iron	\$24.99	1	\$26.61
fan blades	\$0.75	30	\$28.96
8 position DIP switch	\$1.13	30	\$36.10
7-segment display	\$1.57	30	\$56.16
Solderless PCB Breadboard with Wires	\$6.67	20	\$142.07
resistor 50ohm (250 pack)	\$8.13	1	\$6.00
3VDC motor	\$2.84	25	\$75.62

photoresistor \$0.89 10 \$9.48
incandescent bulb(1.5VDC) \$1.99 40 \$84.77

Will a substitute teacher be required? If so, for how many days?

not required

Will there be funding from additional sources? If yes, please describe.

No additional funding is necessary. Some supplies, such as multimeters and other electrical test equipment, that previously purchased by the schools will be utilized to be able to complete the project.

Who are the students who will benefit from this grant?

The equipment purchased by this grant will be used by the 31 students currently enrolled in the new Intro to Engineering elective course as well as the 80 students currently enrolled in CP & Honors Physics. Physics is typically taken by 10th and 11th grade students, while the engineering course is a newly created half-year course available as an elective to any student with no prerequisites.

What is the problem or gap this grant will help address?

Electricity is a difficult subject to for some students to understand so by using an inquiry-based approach, it makes the knowledge more accessible to all learners.

How will you determine whether the project has successfully met your objectives? Describe specific means for evaluation.

A pre and post unit test will be given to the students to be able to analyze the effectiveness of the curriculum and discover possible areas for improvement for next years' courses.

What else do you want us to know?

The curriculum developed by the Museum of Science maps directly to the Standards for Technological Literacy (ITEA 2000), Benchmarks for Science Literacy (AAAS 1993), and National Science Education Standards (NRC 1996) as well as the Massachusetts state science frameworks. The following is an excerpt from the Engineering the Future: Teacher's Guide:
"Engineering the Future is...designed to introduce students to the world of technology and engineering, as a first step to becoming technologically literate citizens. Additionally, the course will help high school students answer the question, "Why should I study math, science, and engineering if I don't plan on a technical career?"