

TARGET TEAM ACTION

To enable students in a Grade 8 Euclidean Geometry seminar to learn real-world applications of geometric concepts, become familiar with digital fabrication technologies including InkScape vector graphics, SketchUp and/or Solidworks CAD software, Rapman 3-D printing, and lasercutting, then apply these technologies, using the Engineering Design Process, to the design and fabrication of an architectural model.

CONTEXT

In school year 2012-2013, we are blessed at Weston Middle School with having a cohort of students who, while in Grade 7, completed Grade 8 Advanced Algebra. Working with the parents and the school principal, it was elected to enroll these students in a 24-week Art of Problem Solving course in Euclidean geometry, and have a faculty member facilitate their work, maintain accountability, and provide geometry-related enrichment activities.

This project, at core a classic geometry course, will enable to apply these classic concepts using 21st-century digital fabrication tools to a real-world architectural problem.

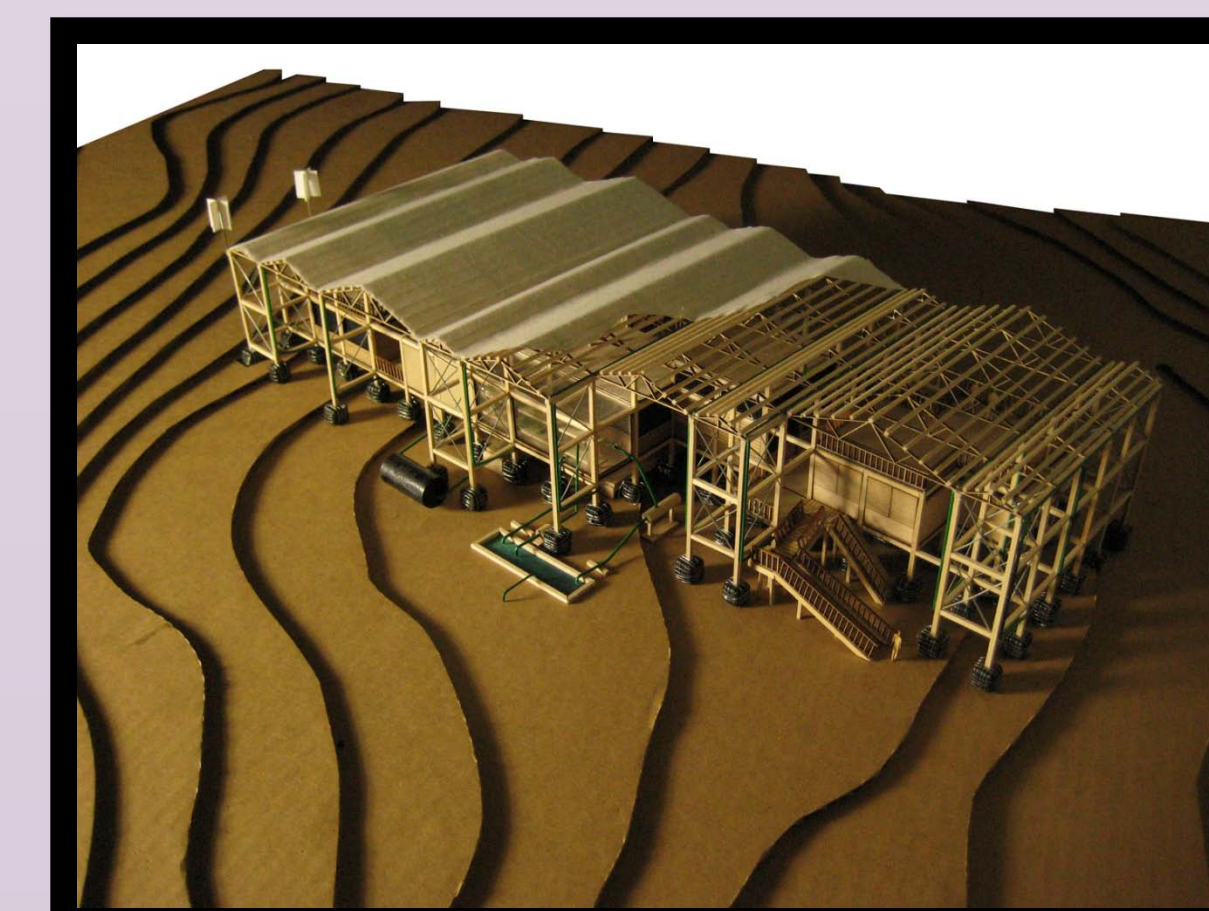


BARRIERS

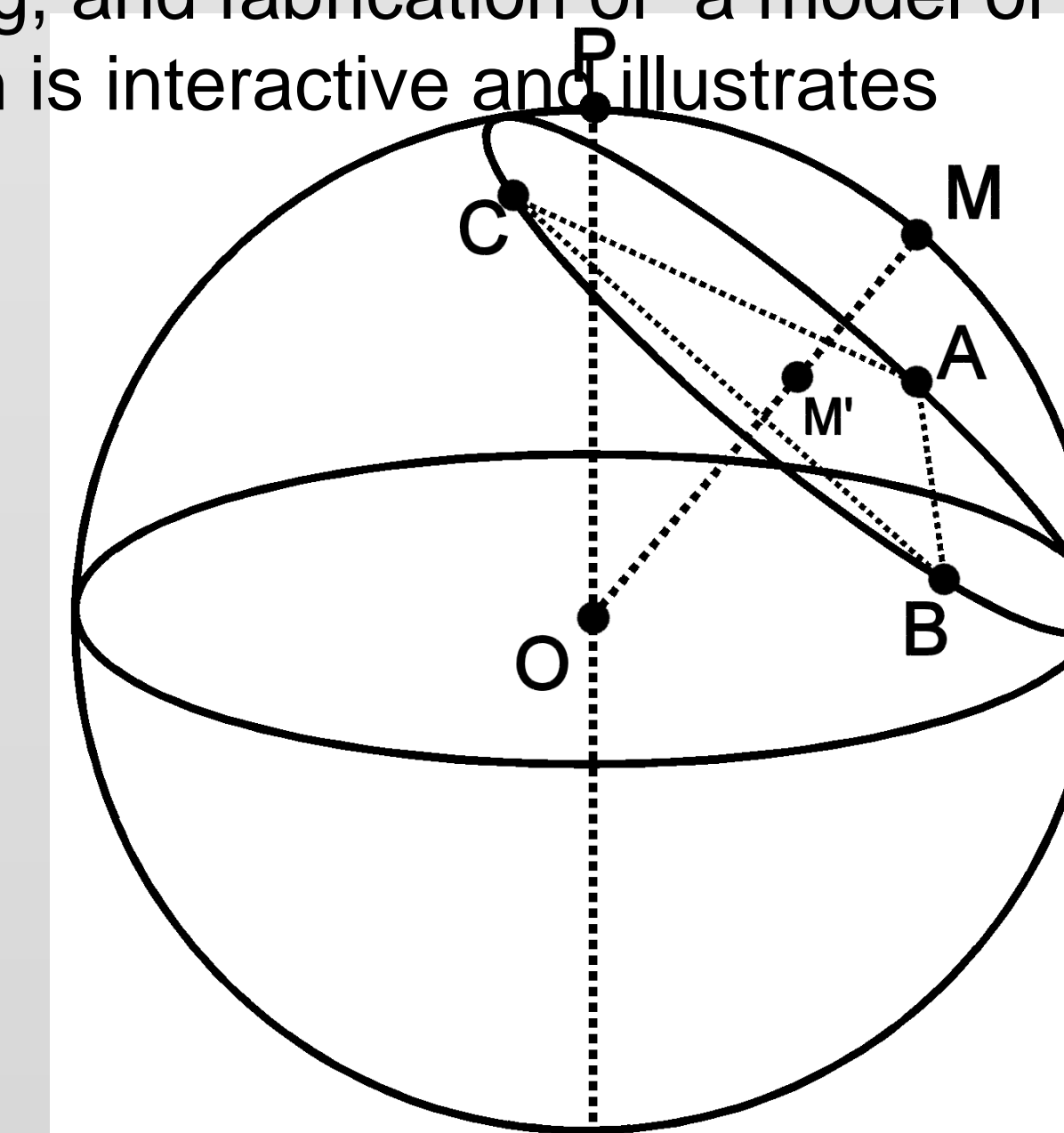
- Coordinating support from university partners at Tufts and MIT
- Developing expertise in use of 3D printer, including file formats and editing of models
- Mastering exporting of SketchUp files to SVG format
- Balancing enrichment activities versus time spent on core geometry concepts
- Coordinating independent study by students



- September 4th- 24th :
 - Course Introduction
 - Introduction to technology tools- AoPS, Khan Academy, Blogger
 - Historical Background for Euclidean Geometry; Video: Agora
 - Outdoor Geometric Constructions
 - Complete SketchUp Tutorials
 - Model Gehry buildings using SketchUp
 - 3D Printing of miniature building
- September 24th- March 5th:
 - Geometry: The Art of Problem Solving Online Course
 - Supplemental material from Khan Academy
 - Geometry and Woodworking
 - Course Introduction;
 - Construct Plywood models of Euclidean problems
 - Inkscape Vector Graphics Tutorials
- March 5th- June 16th:
 - Lasercutting tutorials
 - Plan Architectural model using Engineering Design Process and Design Thinking
 - Fabricate Model
 - Report on Geometry and Architecture
- Optional: Use Arduino Microcontroller to making an interactive building that responds to user's presence and/or environmental conditions.



- Become familiar with concepts of Euclidean Geometry
- Become self-motivated learners and problem-solvers
- Become fluent in solid modeling using SketchUp
- Understand how to export files in SVG format
- Understand 3D printing setup and printing using the Rapman 3D printer
- Become familiar with basics of vector graphics using InkScape
- Be able to design and fabricate parts using a laser cutter
- Learn to apply the Engineering Design Process and Design Thinking to the design, debugging, and fabrication of a model of a building or other structure which is interactive and illustrates geometric concepts.



REFERENCES/HANDOUTS

Massachusetts Frameworks for Mathematics
<http://www.doe.mass.edu/frameworks/current.html>

The Art of Problem Solving Geometry course:
http://www.artofproblemsolving.com/School/courseinfo.php?course_id=intro:geometry

Khan Academy- Geometry
<http://www.khanacademy.org/#geometry>

The House that Euclid Built <http://youtu.be/no09CQGrFiQ>

Video: Sketches of Frank Gehry: <http://youtu.be/O6TAs2WptEA>

SketchUp Tutorials http://youtu.be/gsfH_cyXa1o

Lasercutter Tutorials (AS 220 Labs)
http://www.as220.org/labs/fabacademy/tutorials/using_epilog_laser.html

Stanford D-school:
Design Thinking : <http://dschool.stanford.edu/>
Point of View: <http://dschool.stanford.edu/our-point-of-view/>