

## Integrated STEM Projects for 3D Printing

### Doorstop Project - Introduction to Design, CAD Modeling and 3D Printing

**Target Grades: K-4**

**For Complete CAD Modeling/3D printing tutorial for this project visit**

[D2MD YouTube](#)

#### **Core Concepts Integrated:**

**CAD Modeling** - suggested software for student use: TinkerCAD \*\*If collaborating with MS or HS students, Fusion 360 would be recommended.

**Engineering/Design Process** - any process will work, but highlighting trial and error learning through testing and user feedback is very important. Students can play with size, shape, material, plastic type, etc. to create the best door stop.

**Measurement** - teachers can implement a variety of concepts from scaling measurements, to converting between standard and metric, to using proper measuring tools.

**Shapes** - starting with triangles makes sense as students have models they can use for reference. However, learning what defines these shapes is one of the mathematical applications. Consider having students choose a different shape to compare to the classic triangle.

**Angles** - examples for triangles: obtuse vs. acute; addition of angles equals 180; types of triangles.

**Physical Science** - strength of parts based on 3D printing settings (i.e. print orientation, infill, type of plastic) Friction: this plastic will slide on tile or carpet - students can attempt to create patterns in the plastic or adhere other material (like rubber) to the bottom to minimize slipping.

**Fun** - students can customize the doorstop with teacher's names, room numbers, etc...

**Scope and Sequence** (this is only a suggestion, please modify to suit you and your needs).

- Explore current door stops available at your school.
  - What are they made out of?
  - What shapes are they?
  - What is unique about their design that could help how it functions?
  - What are the measurements for this particular doorstop?

Students can keep a record of their research in a design journal or any other format.

- Teacher interview
  - Each group can interview a teacher who will end up receiving the doorstep
  - Students can determine proper questions to ask regarding shape, color, and customization (i.e. room number)
  - Students can look at specific conditions
    - Distance of gap between door and floor
    - Type of flooring the doorstep will be in contact with
  
- Math content
  - Teacher will cover necessary STEM content **\*\*I would leave out friction and let that be a moment of Inquiry-based learning or problem-solving/troubleshooting\*\***
    - Shapes and angles inherent to them
    - Measurement - standard vs. metric and conversions
    - Estimating measurements and rounding
  
- Design process
  - Students use drawings to sketch out their plan
  - Students then create rough model out of cardboard and recycled materials
  - Students then CAD Model their design
  - Teacher prints out prototype
  - Students test their 1st iteration and get feedback from their specific teacher on the design.
  - Students continue to iterate **\*\*THIS IS HOPEFULLY WHERE THEY WILL NEED TO ADDRESS THE SLIPPING OF THE PLASTIC!\*\***
  
- Presentation of the doorstep to their specific teacher
  - Recruit these teachers to help with grading (give them rubric of what you want to see in the presentation that was evidence of learning)
  - Follow groups throughout the school as teams present their doorstep to teachers
  - Ensure students communicate their process, how they failed/succeeded, etc.

**\*\*NOTE TO TEACHERS - INCLUDE YOUR ADMINISTRATION EVEN IF THEY DO NOT HAVE A DOOR. THEY WILL BE BLOWN AWAY BY WHAT THE STUDENTS DO. THAT IS GOOD FOR THEM AND YOU!\*\***

Looking for tutorials on CAD Modeling and 3D printing? Check out our social media at

