6TH GRADE 4-H

3-D DESIGN

Designing Solutions

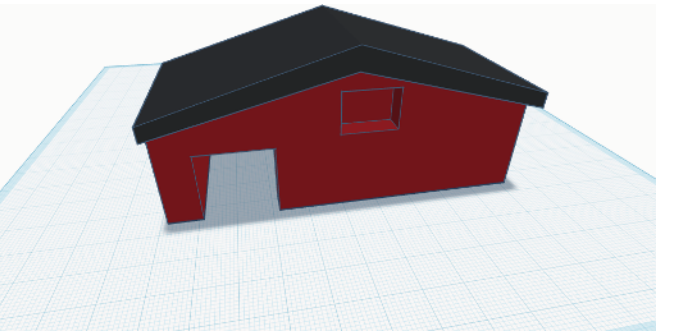
Before Arrival:

- Before arriving make sure that all students have access to Tinkercad and have accounts already set up.
- A small prize, or a few small prizes, are a good idea (but not required)
- If you can arrange to have extra mice available, they will help with the design process; however, they are NOT required.

Materials: A computer, with a Tinkercad account, connected to a projector/screen. Access to the video: www.youtube.com/watch?v=-zUcqwoq_c0 (This video will help students understand some of the basic commands in Tinkercad.)

Day #1:

Let the students know that they will be making a very basic 3-D doghouse with you today; and, afterwards, they may be able to "play" with the program. Play the video, and walk through every step with the students. Stop the video after each command, and walk the class to help any student who has an issue. Remember, you can remove 3-D features by highlighting and hitting the delete button at the top left of the page. Without a mouse, use the block in the upper left to control movements around the workspace. You can zoom-in/out fairly



easily with the track pad. If the workspace gets a little off-center, use the "F" button to recenter.

At the end of day one, let the students use any extra time to explore, and build "cool" buildings.

Day #2

Start the class by reviewing some of the skills the students learned on Day #1.Remind them to use the block in the upper right to move around the workspace, along with the track-pad to zoom in and out.Also, remind them of the importance of grouping—when they are ready.Also, let them know that if they are not signed-in, nothing they do will be saved.

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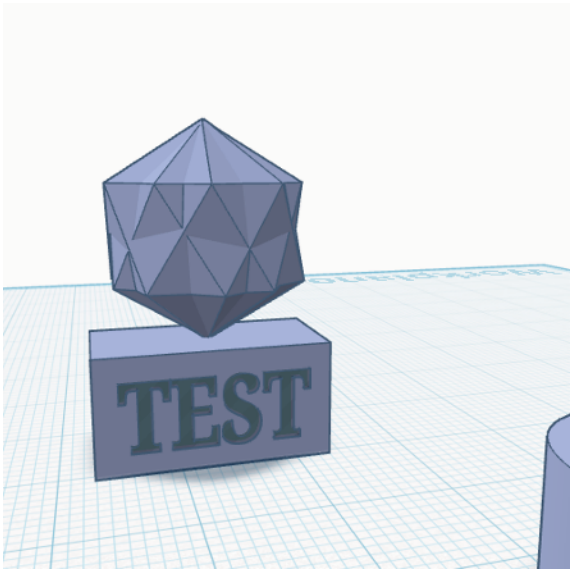
Tell the students that we are going to have a contest to see who can come up with the best design by the end of the period. The criteria for "best" include: 1. Will it work? 2. Does it appear to be safe? 3. If it needs to be mounted, has the designer added a way to "mount" the item? 4. Does it appear to be strong enough for the purpose intended? Students have the choice of inventing a desktop colored pencil holder for 12 pencils, a bath-towel wall holder, a handle to put next to a door in order to assist stability for those with disabilities. They are constrained, by our theoretical 3D printer, to use no more than 10 x 10 inches (254 mm x 254 mm) for any part. They can make multiple parts, if needed. They are not allowed to copy something pre-made off of the program/internet. They are also constrained by time. Their designs will be evaluated during the next class period.

To wrap up, let the students know that Tinkercad, and another program, Sketchup, are free and available to all. Free videos are available to help students learn to use the program features. Many schools and public libraries have 3D printers; and, they may allow use for free, or for a minimal charge. In other words, there is nothing keeping these students from learning more about 3D design and engineering.



Day #3:

Classroom Instructor Leads/4-H Volunteer Optional

Allow the students a "few" minutes to clean up their designs. During this time, visit the students and decide which designs look best. Give extra consideration to "well-designed" parts. In the case of a handle for next to the door, a strong (thick) handhold, holes for mounting screws, and rounded edges would rank exceedingly high in judging. Make sure to pick multiple designs for the same need.

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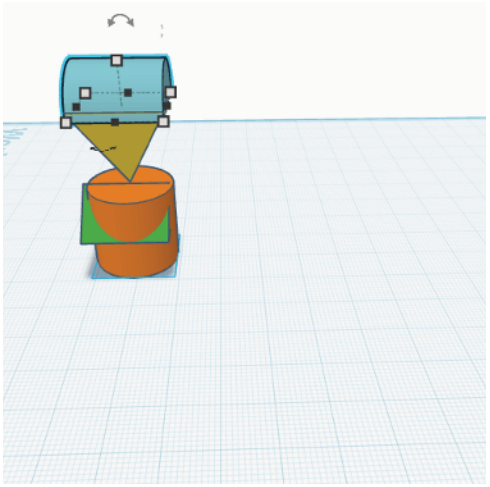
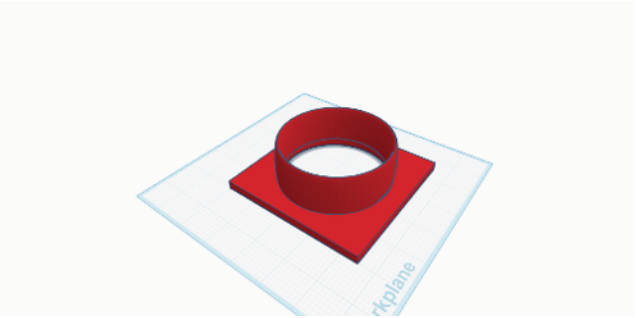
Show some of the best student designs on a projector. Ask the class if they can think of ways to improve these designs? Can we take some properties from one design and add them to another? Allow some time for brainstorming. Ask, what could we learn by actually "printing" these projects, instead of just viewing them on the screen? (Answers will vary; but, students should realize that having the actual part would use useful for strength testing, seeing how heavy something will be, seeing how something works "in real life," finding out if the item is stable enough--won't fall over, rip off the wall, etc.)

If any time remains after judging multiple designs, let the students experiment with designs of their choosing.





Indiana Standards:

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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