

The Right Tool for the Job

Media Production: 3D Printing

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Grade Level	6th – 12th Grade	**Time Frame**	120-180 minutes
Course	Any Secondary Course	**Duration**	3 class periods

Essential Question

Why do people use 3D printers?

Summary

Students will discover one of the primary purposes of 3D printing is the ability to create something you need, when you need it. They will use the free online platform Tinkercad to develop their understanding of 3D modeling and design. Based on that understanding, they will work in groups to complete an authentic learning challenge, designing a wrench that will fit a specific bolt. Students will 3D print and test their finished model reflecting on the process and what they would change in the future.

Snapshot

Engage

Students reflect on the purpose of 3D printing by sharing what they know about 3D printing and discussing why people do 3D printing. After viewing a video on 3D printing prosthetic hands, they talk about other possible purposes for 3D printing.

Explore

Students complete a Tinkercad scavenger hunt to learn the basics of 3D design.

Explain

Students observe existing 3D models of a wrench and compare and contrast their features.

Extend

Groups of students are given a bolt to measure and are challenged to modify an existing 3D model of a wrench to fit their bolt.

Evaluate

Students print and test their wrench, reflecting on what went well and what they would want to change in their next design.

Standards

ISTE Standards for Students (For Students (2016))

ISTE4: Innovative Designer- Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
ISTE4a: Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
ISTE4c: Students develop, test and refine prototypes as part of a cyclical design process.

Attachments

- Design Challenge—The Right Tool for the Job - Spanish.docx
- Design Challenge—The Right Tool for the Job.docx
- Design Notes and Revisions—The Right Tool for the Job - Spanish.docx
- Design Notes and Revisions—The Right Tool for the Job.docx
- Lesson Slides—The Right Tool for the Job.pptx
- Tinkercad Scavenger Hunt—The Right Tool for the Job - Spanish.docx
- Tinkercad Scavenger Hunt—The Right Tool for the Job.docx

Materials

- Tinkercad Scavenger Hunt (attached; one per student)
- Design Challenge handout (attached; one per group)
- Design Notes and Revisions handout (attached; one per group)
- Lesson Slides (attached)
- 3D printer
- Filament
- Student devices
- Bolts (one per group)
- Pencils or pens
- Whiteboard or chart paper

15 minutes

Engage

Introduce students to the essential question and learning objective for the lesson using **slides 2-4**. Display **slide 5**. Using the T-Chart strategy, have students divide a paper in two. On one side, have them identify what they know about 3D printing and why people use 3D printing on the other. After the activity, have students share out with the class and compile their list of answers on a whiteboard or chart paper. Display **slide 6** and play the How 3-D Printed Prosthetic Hands Are Changing These Kids' Lives video.

Embedded video
https://youtube.com/watch?v=Cl8ijPGEKO8

Instruct the students to revisit their T-Chart and add any new information that they learned from the video.

35 minutes

Explore

Teacher's Note

Before starting this section, instruct each student to log-in to their computer and open their web browser. Students will be using Tinkercad. See the K20 Center's Tinkercad Tech Tool to learn more about this site and how to set up a teacher account.

Display **slide 7**. Distribute the **3D Printing Tinkercad Scavenger Hunt** handout and instruct students to follow the instructions on the page. The students should complete every step.

Following the activity, have students debrief sharing what they liked about the platform and what they found to be difficult.

20 minutes

Explain

Display **slide 8**. Instruct the students to break into groups 2–3. Distribute a copy of the **Design Challenge** handout to each group.

Have the students complete Part 1 of the handout.

Teacher's Note: Bolts

As the students are completing their tasks, take this opportunity to distribute the bolts for the next step of the lesson. For younger classes, you can use a uniform bolt size so students can easily learn from each other. When teaching more advanced students, you can have the students use different bolt sizes so they cannot rely on the work of others and each wrench is unique. If using different sizes, make sure to label the bolt with a letter and have the students record which bolt they used.

After every student has completed the first three steps, invite some to share their observations with the class. Ask the groups to share what they noticed about the different designs and what made them decide to pick the one they did for remixing.

30 minutes

Extend

Display **slide 9.** Instruct the groups to now complete Part 2 of the Design Challenge handout. As they are doing this, move from station to station ensuring that no students are designing below the plate or making errors that will cause their wrench to print incorrectly by checking their work from all angles.

Teacher's Note

End the lesson here so you can print the student designs. Should you not have enough time to print them all, select a few of the designs to use as examples. Make sure to collect the respective bolts for those groups so you can use them in the example for the next part of the lesson. Start the next step of the lesson when you have completed the prints.

40 minutes

Evaluate

Teacher's Note

The Design Notes and Revisions handout can be printed or digitally assigned to students. If they complete their handout digitally, have them share the file with you when they are finished.

Display **slide 10**. Test the printed wrenches with the bolts and have students write notes on their observations on the **Design Notes and Revisions** handout. Remind the students that our goal is to learn about the design process, and that sometimes we have to revisit things and refine them. A wrench that doesn't fit the bolt isn't a failure, but a step in the process. In their notes, have them answer the following questions:

1. What about this design works?
2. What about this design doesn’t work?
3. If I were to refine the design, what would I do differently?

After they have completed this task, display **slide 11**. Give students time to refine their wrench designs in Tinkercad and have them document any changes they made on their handout. Also instruct them to write a short reflection on why they decided these changes were the best option for their wrench. The handout can be used to check their understanding of the design process and their ability to analyze and modify their work.

Resources

- K20 Center. (n.d.). T-Chart. Strategies. https://learn.k20center.ou.edu/strategy/86
- K20 Center. (n.d.). Tinkercad. Tech Tools. https://learn.k20center.ou.edu/tech-tool/2166
- National Geographic. (2015). *How 3-D-Printed Prosthetic Hands Are Changing These Kids' Lives | Short Film Showcase* [Video]. YouTube. https://www.youtube.com/watch?v=Cl8ijPGEKO8