Lesson Plan 2

Discovery of 3D Design Using Tinkercad

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Discovery of 3D Design Using Tinkercad: Lesson 5

Design a Stamp

Learning Targets

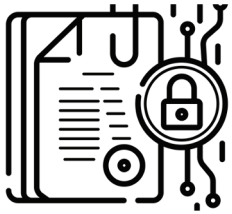
- I can create a detailed sketch of a design solution.

Stamp It Out


ORIGINAL
ORIGINAL
ORIGINAL
ORIGINAL


TRUSTED
TRUSTED
TRUSTED
TRUSTED

Design Process and Development



Define
Criteria and Constraints

Identify
Problem or Question

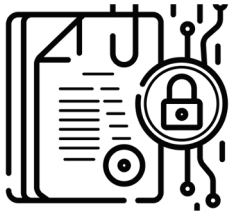
Imagine
Solutions

Design, Build, Test, Improve

Develop
Solutions

Share
Results

Design Process to Create a Stamp



Define
Criteria and Constraints

Identify
Problem or Question

Imagine
Solutions

Design, Build, Test, Improve

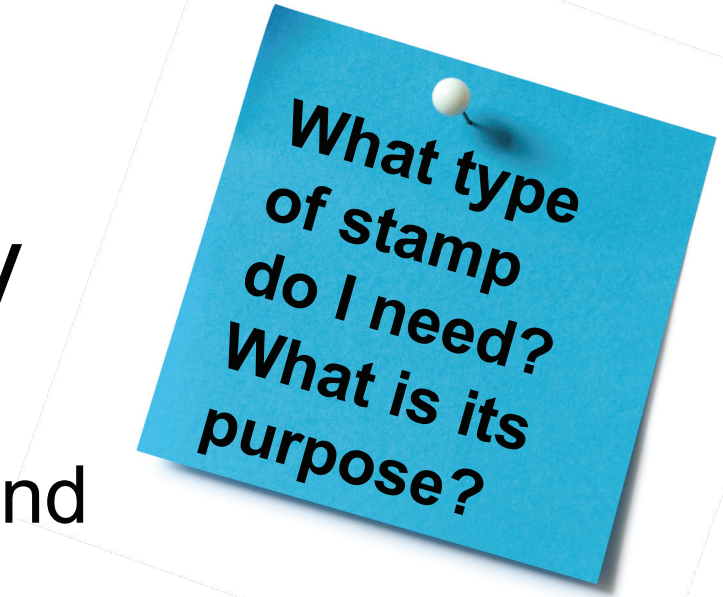
Develop
Solutions

Share
Results

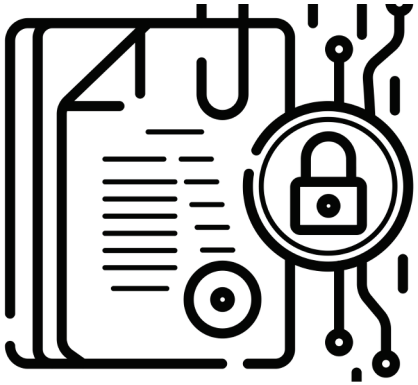
Design Process to Create a Stamp

Identify

Questions and Problems



Design Process to Create a Stamp



Define Criteria and Constraints

Stamp Constraints

Must include:

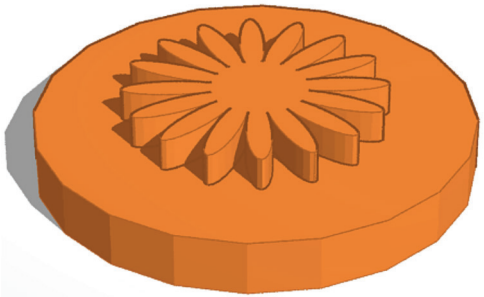
- A base to hold - height = 5mm
- Extruded part - height = 3mm

Overall dimensions:

- Length - 40mm - 100mm
- Width - 40mm - 60mm

Stamp*FirstInitialLastName*

***Stamp*BKnowles**

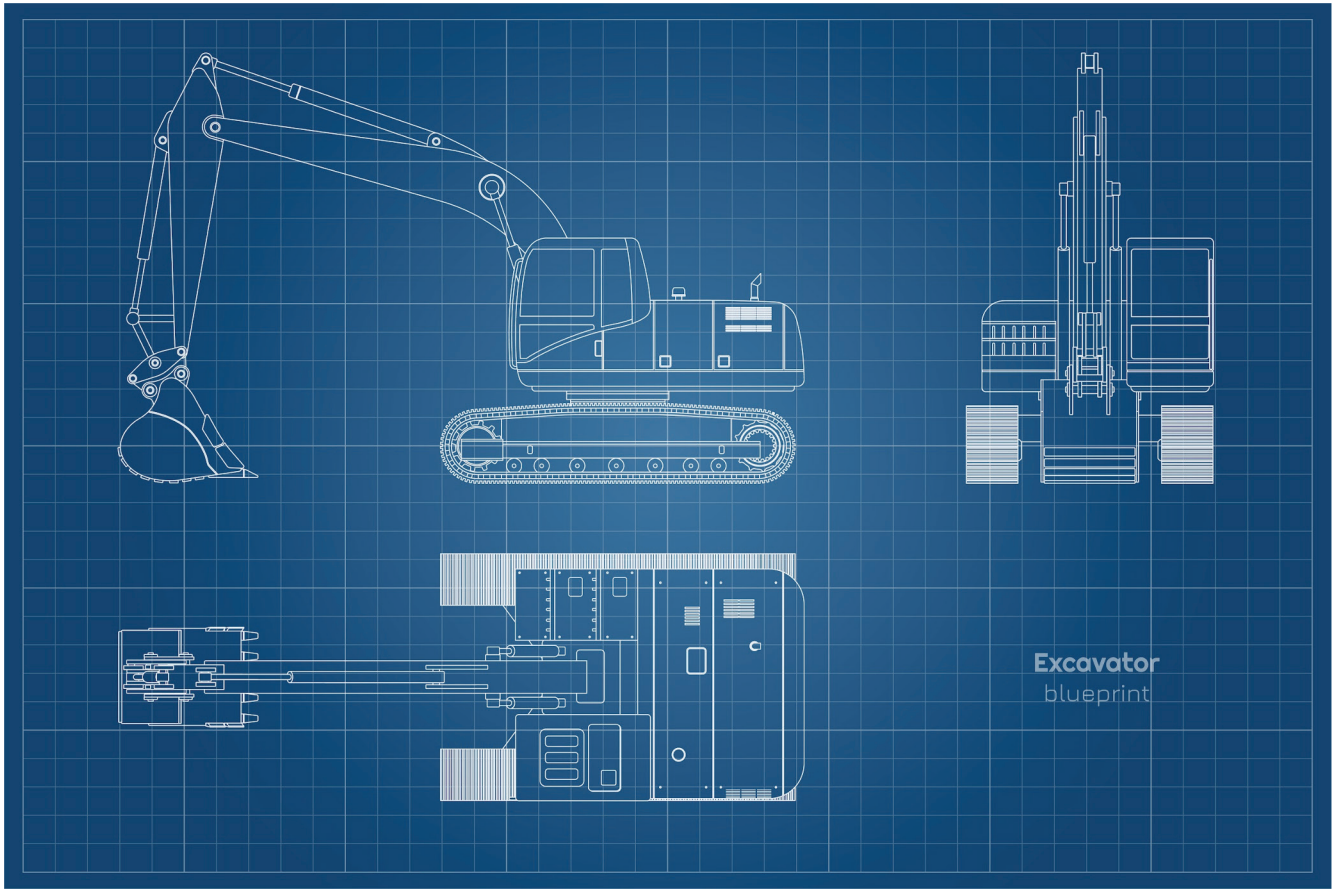


Imagine a Personal Stamp

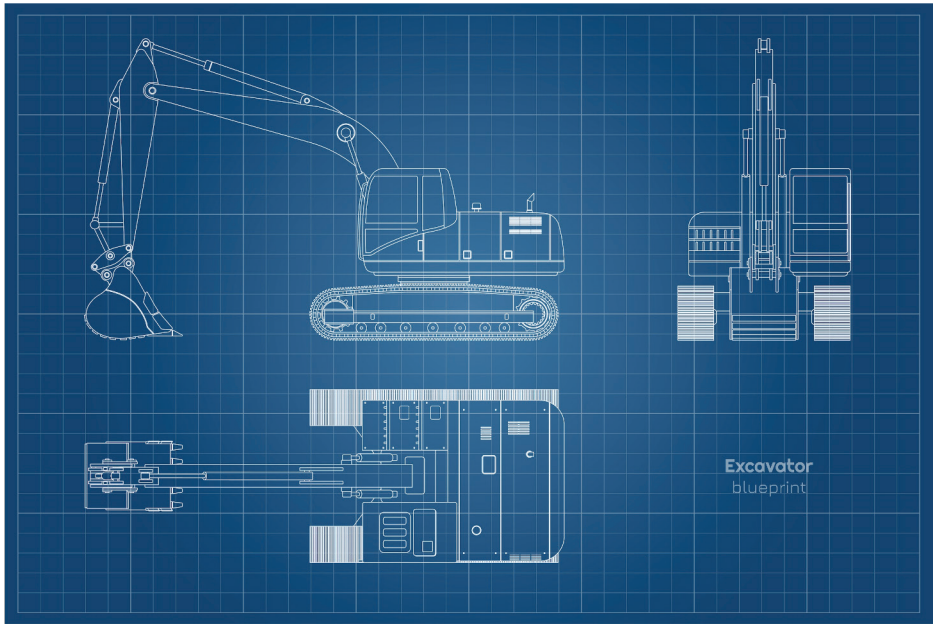
Imagine

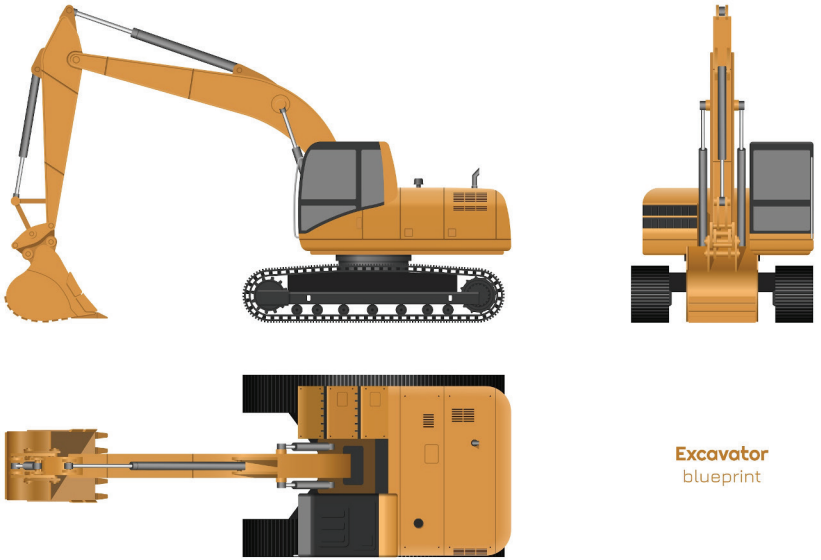
Solutions

Design a Blueprint



Blueprint to Sketch





Learning Targets

- I can create a detailed sketch of a design solution.

Discovery of 3D Design Using Tinkercad

Lesson 5: Design a Stamp

LESSON SUMMARY

In this lesson, students will expand their design skills by designing other 3D objects to be 3D printed. Students also create a detailed sketch of an object using steps of the engineering design process.

LEARNING TARGETS

- I can create a detailed blueprint and sketch of a design solution.

STANDARDS SUPPORT

NGSS

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Science and Engineering Practices

- ❏ Asking Questions and Defining Problems
  - ❏ Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Disciplinary Core Ideas

- ❏ **ETS1.A:** Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

Crosscutting Concepts

- ❏ **Influence of Science, Engineering, and Technology on Society and the Natural World**: People's needs and wants change over time, as do their demands for new and improved technologies

CCSS

Math

- ❏ **MP.2** Reason abstractly and quantitatively.
- ❏ **MP.5** Use appropriate tools strategically.

ISTE

Empowered Learner Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

Computational Thinker Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

- ❏ **5d** Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

CSTA

Algorithms and Programming

- ❏ **1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.

21st Century Skills

- ❏ **21stCS_1** Critical thinking, problem solving, reasoning, analysis, interpretation, synthesizing information.
- ❏ **21stCS_11** Scientific literacy and reasoning, the scientific method.

INSTRUCTIONAL MODEL

1. Engage: Pique Interest and Prior Knowledge (5 min.)
2. Explore: Engineering Design Process (5 min.)
3. Explain: Define Criteria and Constraints (5 min.)
4. Elaborate: Imagine and Design (40 min.)
5. Evaluate: Learning Review (5 min.)

MATERIALS

- Laptop/tablet (for PPT display)

- Classroom whiteboard and markers
- Student Worksheet for Lesson 5
- Lesson 5 Presentation
- Computers or Tablets with Internet Connection
- Tinkercad Classrooms available on teacher's laptop
- Tinkercad Keyboard Shortcuts sheets (1 per student)

LESSON PLAN

Engage Pique Interest and Prior Knowledge (5 min.)

- **Slide 2:** Begin lesson by looking at the images of stamps that were created by 3D design and printing software.
    - **ASK:** Where have you seen a stamp before? What is your first thought when you see these stamps made from 3D design and printing software? What has changed about how you think about 3D printing after seeing everyday objects like these?
    - Remind students that 3D designs have many applications. Reiterate that some 3D designs are developed to help visualize an initial concept, while others are to have a tangible example of how a final product may look and feel. Point out that very different industries such as manufacturing, fashion or architecture all use 3D design when building products.
    - Remind students that 3D design on a computer is useful because we can design objects that can be used in many different ways, without spending as much time or resources on making a 3D model. Reiterate that 3D design is useful because we can easily and quickly change a design and simulate how it can be used and how it will interact with other objects.
    - **ASK:** What other objects do you imagine should be designed in 3D using CAD software before people build them?" [Answers will vary. Students should respond that infrastructure elements like buildings and roads should be designed in 3D first.]
    - Remind students that 3D design and 3D printing are a part of what's called the **Design Process**. Reiterate that the Design Process is a critical part of how many objects that we use everyday are made.
- **Slide 3:** Display the Learning Targets and invite a student to read aloud.
    - I can create a detailed blueprint and sketch of a design solution.

Explore Engineering Design Process (5 mins)

- **Slide 4:**
    - **ASK:** What is the engineering design process? When and why do we use it?
    - Tell students that in this lesson they will learn about how the Engineering Design Process informs development.
- **Slide 5:**
    - Tell students they will be using the first four steps of the engineering design process to design a personalized stamp.

        - **ASK:** What is a stamp? What do you notice about these stamps? What type of considerations do you need to think about when designing a stamp? [Students' answers may vary. Guide them to understand that letters on stamps need to be created backwards so that they appear forwards when the stamp is inked and transferred to another surface].
- **Slide 6:**
    - Explain to students that in the first step ***identify***, the designer asks questions and identifies problems that the stamp might solve.
    - **ASK:** What purpose can you think of for creating a stamp? [Students' answers will vary, but guide them to consider a signature stamp for someone who lost fine motor control and can no longer write].

Explain Define Criteria and Constraints (5 min.)

- **Slide 7-8: Define Criteria and Constraints**
    - Explain that in all engineering problems, there are criteria and constraints that need to be considered. Like size, and weight, and shape, and cost.
    - **ASK:** What are some of the criteria that come to mind when you think about what you need from your stamp in order to achieve your purpose? What are the constraints?Instruct students to complete the second half of the daily worksheet, by sketching the listed objects.

Elaborate Imagine and Design (40 min.)

- **Slide 9: Imagine and Design**
    - Have students begin to imagine what their personal stamp could look like.
    - **ASK:** What is the purpose of your stamp? What are the criteria and constraints to consider?
    - Tell students it is also important to list what materials will be needed to complete your design.
    - **ASK:** What materials do you think you will need to design a solution for your stamp? [Students answers will vary and may include, 3D Printer, filament, paper, string, ruler, etc,]
    - Tell students to fill in the questions on the first page of the Student Worksheet.
- **Slide 10:** Design a Blueprint
    - **ASK:** What is a blueprint? How could a blueprint be useful during the development process?
    - **ASK:** What is this a blueprint of? How do you know? What details are in the blueprint that help you determine what this object is (have them point out major parts of the object - bucket, wheel, cab).
    - **ASK:** Why are their different views of the excavator (side, front, top)?
- **Slide 11: Blueprint to Sketch**
    - Tell students that these images are sketches of the same product.
    - **ASK:** How does the sketch compare to the blueprint? Which is more helpful in the design process - the blueprint or the sketch? Why?
    - Explain to students it is important to label key parts of the design so when you go to build it you have a guide to help you.

- Explain to students while they may not have known exactly what the sketches were of, they were able to extract key parts of the drawing based on not only their previous knowledge, but also the labels on the sketch.
- Tell students in the Design step, it is very important to include sketches, labels, and key information about the product they will be designing.
- Have students complete page 1 of the Student Worksheet. Remind them how important details and labeling are to development.
- Share with students that now they will use what they have learned to design and eventually build a stamp using Tinkercad.
- Have students use page 2 of the Student Worksheet to design a detailed blueprint and sketch of their personalized stamp. Encourage them to include different viewpoints of the blueprint and sketch to increase successful building of the stamp in Tinkercad.
- **ASK:** Why is creating a blueprint and a sketch a helpful and necessary step in the development process? Have students answer that on the Student Worksheet.

Evaluate Learning Review (5 min.)

- **ASK:**
  - What is something new you learned today?
  - What was the most exciting thing you discovered today?

- **Slide 12:** Display and reread each Learning Target and invite students to reflect on their learning by showing a thumbs up, thumbs down, or thumbs to the side for each one to indicate their progress.

Discovery of 3D Design Using Tinkercad: Lesson 5

Name: _____

What Can I Do?

- I can create a detailed sketch of a design solution.

What is the purpose of your stamp?

_____

_____

What is the criteria for your stamp? (size, material, color, etc.)

_____

_____

What are the constraints for your stamp? (size, material, color, etc.)

_____

_____

Sketch Draw a sketch of the object below. Be sure to label key features.	
Fork	**Flower pot**
Kitchen sink	**Airplane**

Discovery of 3D Design Using Tinkercad: Lesson 5

Name: _____

Imagine and Design Create a blueprint and sketch of your personalized stamp.

Why is creating a blueprint and a sketch a helpful and necessary step in the development process?

_____

_____

_____

_____

Discovery of 3D Design Using Tinkercad: Lesson 5

Name: _____

What Can I Do?

- I can create a detailed sketch of a design solution.

What is the purpose of your stamp?

Students' answers will vary. Evaluate the extent to which they describe the purpose of their stamp.

What is the criteria for your stamp? (size, material, color, etc.)

Students' answers will vary. Evaluate the extent to which they describe the criteria of their stamp.

What are the constraints for your stamp? (size, material, color, etc.)

Students' answers will vary. Evaluate the extent to which they describe the constraints of their stamp.

Sketch Draw a sketch of the object below. Be sure to label key features.	
Fork Students' answers will vary. Evaluate the level of detail and the labeling of key features.	**Flower pot**
Kitchen sink	**Airplane**

Discovery of 3D Design Using Tinkercad: Lesson 5

Name: _____

Imagine and Design Create a blueprint and sketch of your personalized stamp.
Students' answers will vary. Evaluate the level of detail and the labeling of key features of their stamp and the considerations they made for size, color, material, etc.

Why is creating a blueprint and a sketch a helpful and necessary step in the development process?

Students' answers will vary. Evaluate the extent to which they can use what they have learned during this process to explain how the blueprint and sketch helps in draft and revision and detailing the stamp design before taking it to Tinkercad for development.

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