



# 3-D PRINTING & DESIGN-THINKING

*Towson University Sandbox*

## **Presenter:**

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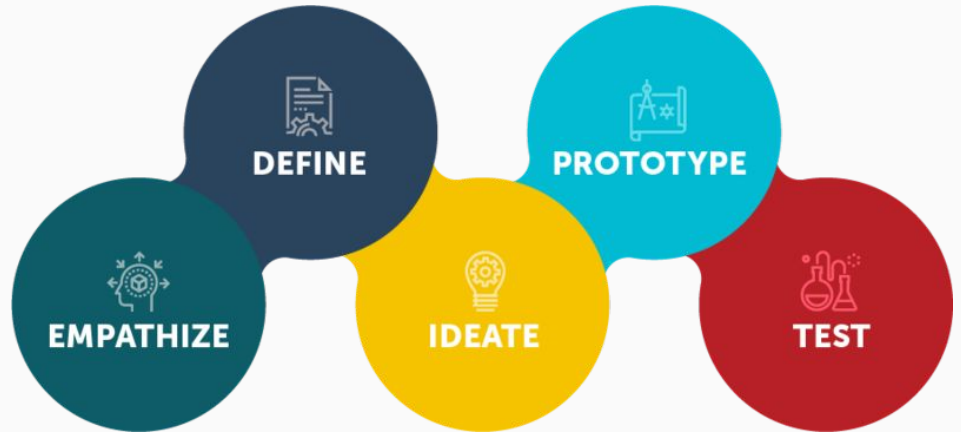
# Overview



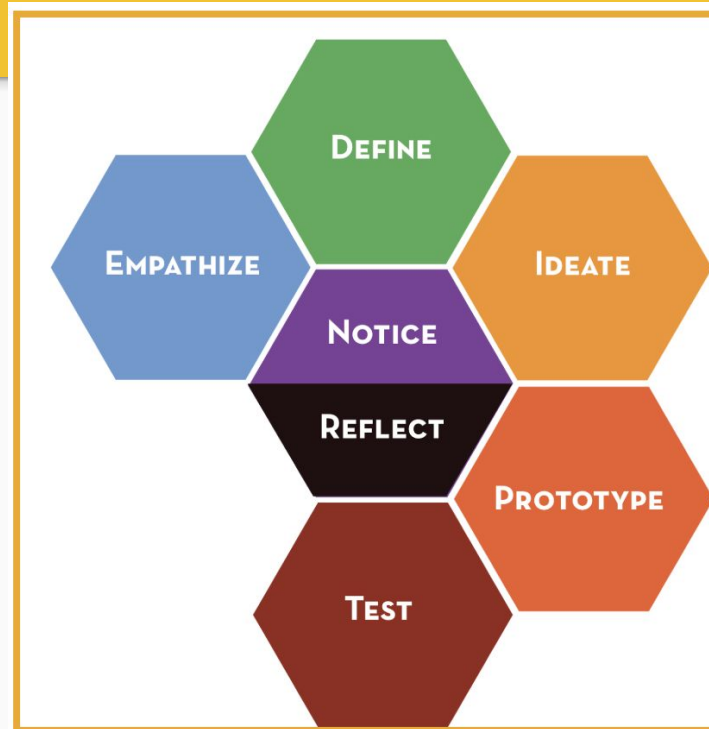
- What is Design Thinking?
- How can 3-D Printing Support Design Thinking?
- Examples of 3-D Printing Projects in Teacher Education
- Examples of Projects in Secondary Education
- Questions

# What is the Design Thinking?

- Design thinking is a problem-solving approach that supports learners in creatively responding to needs.



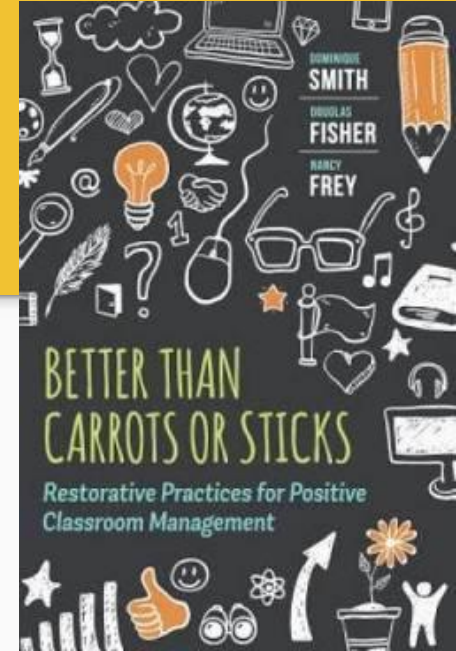
# Equity-Centered Design Thinking



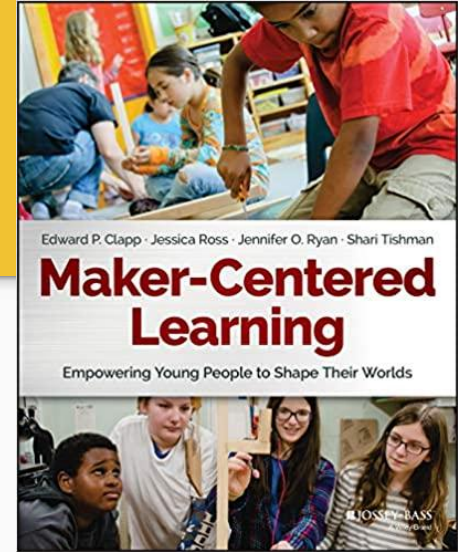
# 3-D Printing to Support Equity-Centered Design Thinking

- In my SCED647 course: *Advanced Processes of Teaching and Learning*, students explore a variety of new pedagogical approaches that can support student learning at the secondary level.
- Topics we explore:
  - Restorative Practices
  - Trauma-Informed Teaching
  - Maker-Centered Learning
  - Computational Thinking

# Restorative Practices

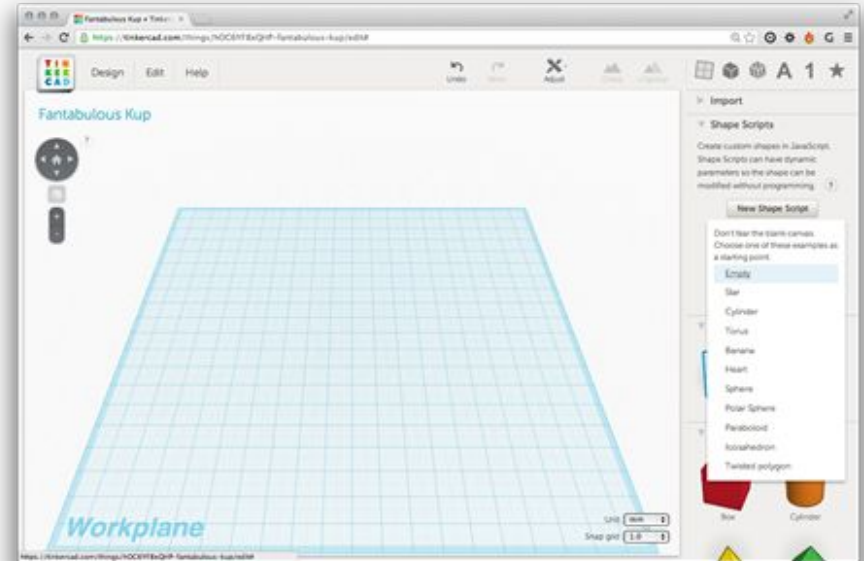


# Maker-Centered Learning



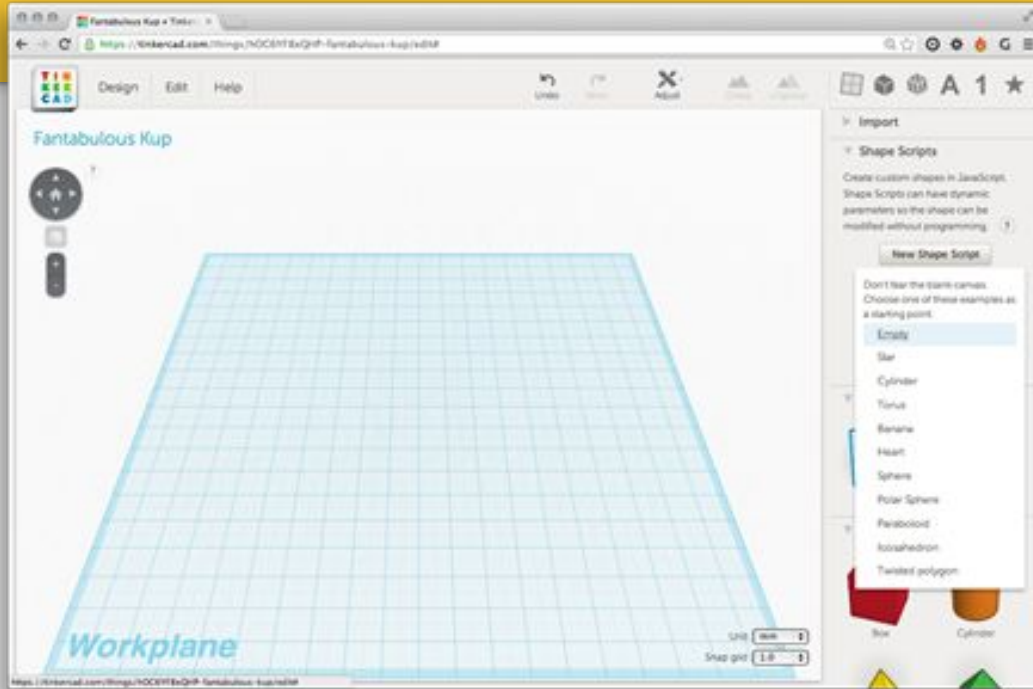
# Tinkercad

- Website: [www.tinkercad.com](http://www.tinkercad.com)
- A free website that can be used for 3D design and printing.
- All designs can be exported as an STL file that can be printed on most 3D printers.

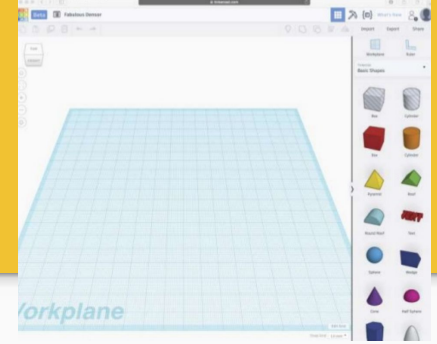




# Tinkercad



# Important Tinkercad Features

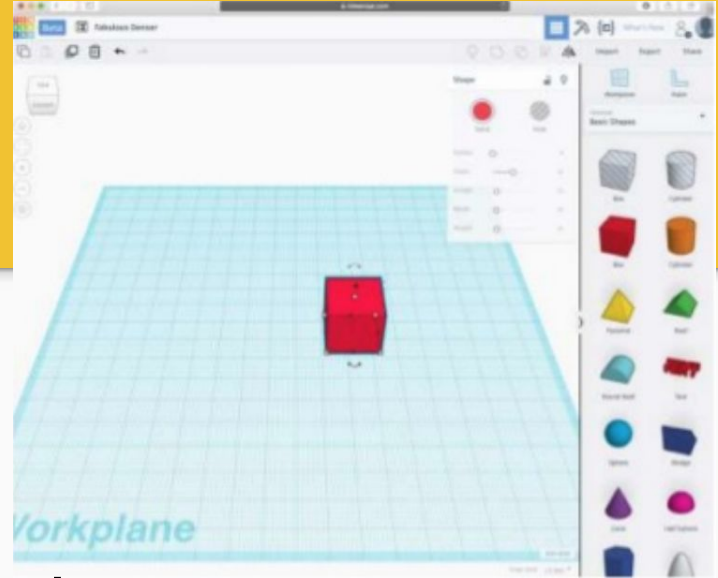


- Top Right Corner: **Import, Export, Share options**
  - **Upload files, download files (as .stl) and share your files as a link**
- Cube in Top Left Corner: **Allows you to move your perspective of your model.**
- Plus and Minus Below Cube: **Allows you to zoom in and out**
- "Edit Grid": **Change your grid scale**

# Getting Started

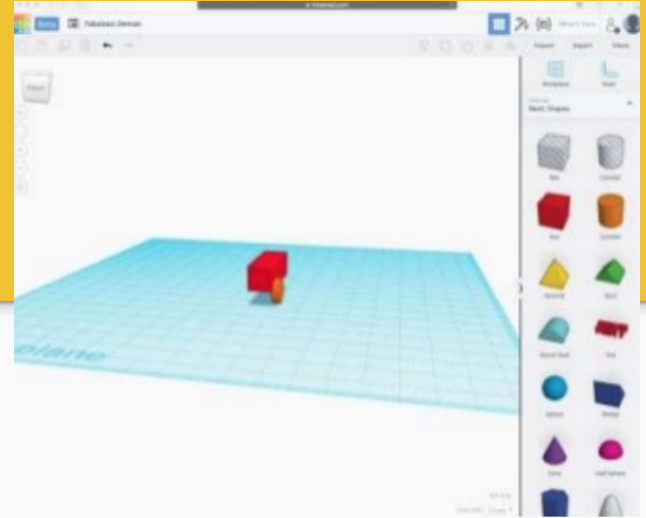
How to start building your model:

- **Begin by dragging a solid shape to the workspace.**
- **If you click on the bottom left corner of the shape, you will be able to see the length and width of the space. You can type in numbers to edit this space.**
- *Note: Default scale of millimeters (mm)*



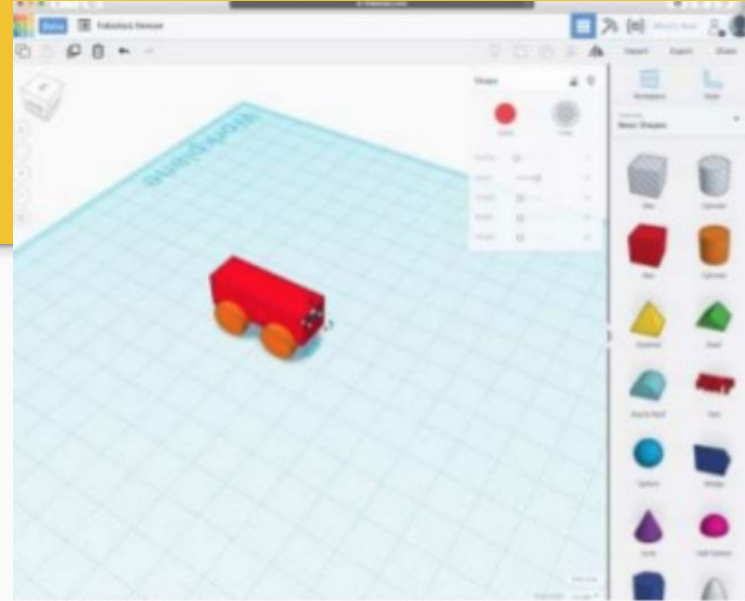
# Let's Build a Car!

- Create a rectangle of 10 x 30 x 10
- Drag it up off the ground
- Add some wheels: Take one cylinder and make the dimensions 10 x 10 x 3.
- Copy it three times (Control C, Control V), and place at desired location around the rectangle.



# The Cutting Feature

- Create a second rectangle and set your dimensions
- Move the second rectangle so that it touches the first rectangle where you want the window.
- Select the “hole” feature in the menu for the shape.
- The hole feature will allow you to cut the body of the car



SCED647: Advanced Processes of Teaching and Learning

# Tinkercad Classroom Design Project



- The classroom environment plays an important role in supporting student learning and effective pedagogical practices.
- ISTE Standards for Educators Alignment:
  - Standard 1:** Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning.
  - Standard 4:** Educators dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources, and solve problems.

# Tinkercad Classroom Design Project



- In this project, students use Tinkercad to design a classroom that they think could best support the integration of Restorative Practices and Maker-Centered Learning.
- Students use Tinkercad to design a physical space, and then they submit a partner reflection that integrates the course readings to explain their design choices.



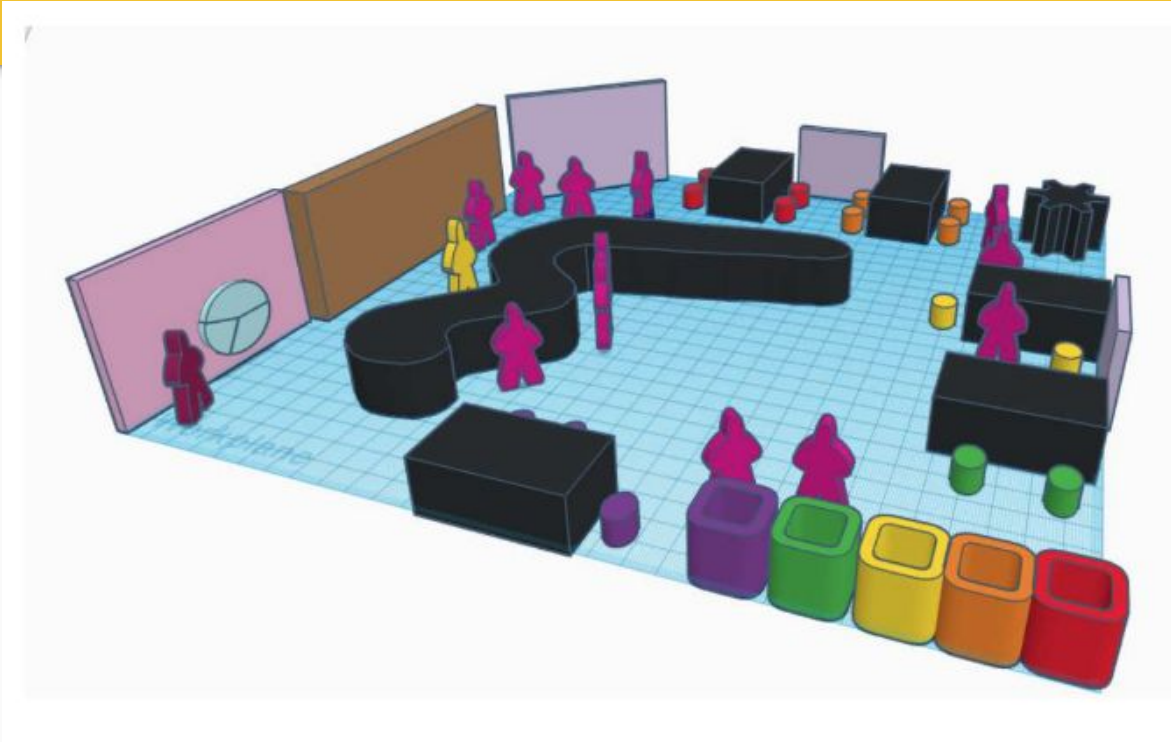
# Tinkercad Project Objectives

*Teacher candidates will:*

- **Demonstrate their understanding of both Restorative Practices and Maker-Centered Learning.**
- **Explore the similarities and differences between Restorative Practices and Maker-Centered Learning.**
- **Critically reflect on the role of instructional environment in implementing Restorative Practices and Maker-Centered Learning.**
- **Explain how the instructional environment can be altered to best support both Restorative Practices and Maker-Centered Learning.**



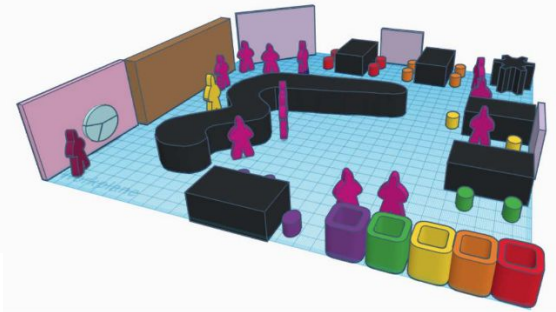
# Student Work Example #1



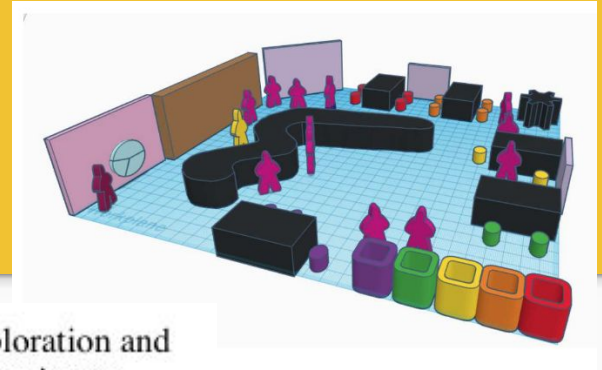
# Student Work Example #1

I designed my Tinkercad.com classroom utilizing the four key characteristics of educational environments and instructional design for effective maker-centered learning.

- 1. Teachers:** The teachers in a maker-centered classroom consist of the students, community members, online resources, and materials (Clapp, Ross, Ryan, & Tishman, 2017). My classroom design includes multiple lab stations and a central work station to facilitate student collaboration. Interactive whiteboards are located around the perimeter of the room, allowing students to present information to other students or the teacher. Students can also utilize laptops from the gear-shaped computer cart to conduct internet research, construct digital prototypes, or find local area resources.
- 2. Teaching:** According to Clapp et al., “The capacity to flexibly teach in different ways is a common characteristic of good teaching in general, so it is not surprising that maker educators, like good teachers everywhere, play multiple pedagogical roles” (p. 59). One important role is the facilitator, in which the teacher provides support and structure for students to complete class activities, as opposed to direct instruction. My classroom design depicts the teacher (yellow figure), working with a small group of students (purple figures) while another student presents information to the group. With a flexible classroom design the teacher can move between student groups as needed, or bring the class together to debrief and provide instructions.



# Student Work Example #1



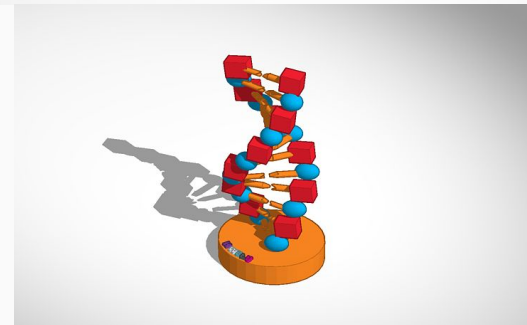
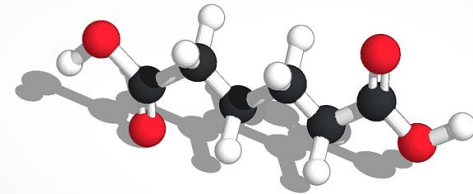
- 3. Learning:** In a maker-centered classroom, students learn largely through exploration and collaboration. Clapp et al claims student learning is visible through students trying to figure things out on their own, through processes such as tinkering, co-inspiration, and co-critique (p. 45). In my classroom design, the central workstation supports the processes of co-inspiration and co-critique. For example, students from each group could place their prototypes on the work station, then participate in a gallery walk to provide feedback to other groups.
- 4. Classroom:** The maker-centered classroom should incorporate tools and materials from multiple disciplines, which should be visible to students to encourage active brainstorming and connections (p. 45). My classroom design includes a large shelving unit which makes learning materials easily accessible. Additionally, color-coded storage cubes provide space for each group to store project materials.

# Student Work Example #2



# Integrating Tinkercad in Secondary Schools

- Create a DNA model
- Represent a chemical compound
- Can support Project-Based Learning or integrate Design Thinking in any subject.

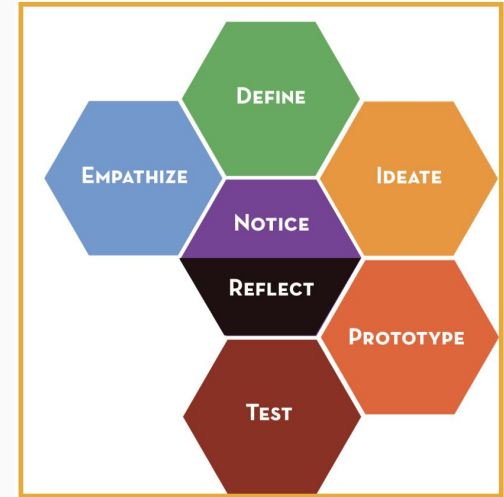
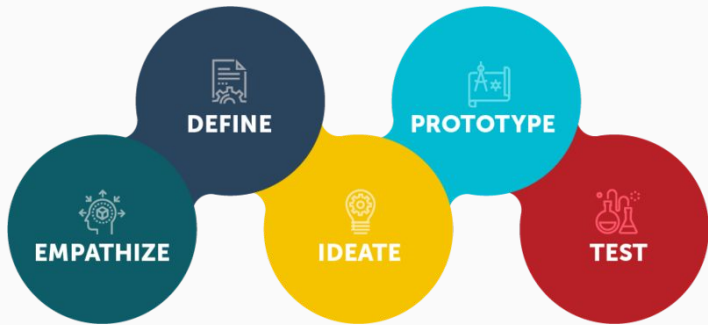


# Tinkercad During Covid

- *Challenge:* Create a clasp that doctors can use to secure their mask so that it doesn't slip.



# Supporting Design Thinking with Tinkercad





Questions?

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