3D Printed Egyptian Alphabet Stamps & Clay Cartouche

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Target Grade Level: Grade 6-8

Time Required: 1 hour over each of 2 days. (2 hours total)

Overview:
Students studying ancient Egyptian history can delve deeper into Egyptian written language and customs by creating a clay cartouche. Instead of carving hieroglyphics by hand, this project requires students to build their own hieroglyphic stamps using 3-D printers and free Tinkercad software. Options are suggested for easier and more difficult projects. At the end of the project, students will have both a clay cartouche and their own stamp which may be used for other projects.

Standards:

TN Visual Arts Standard 6.2.1
Discuss how the unique characteristics of visual art improve comprehension in other academic disciplines.

TN Mathematics Standard G.CO.A.5
Given a geometric figure and a rigid motion, draw the image of the figure in multiple ways, including technology. Specify a sequence of rigid motions that will carry a given figure onto another. (Rotation/Reflection/Translation are inherent in 3D design software)

TN Social Studies Standard SSP.01
Collect data and information from a variety of primary and secondary sources, including:
- Printed materials (e.g., literary texts, newspapers, political cartoons, autobiographies,
- speeches, letters, personal journals)
- Graphic representations (e.g., maps, timelines, charts, photographs, artwork)
- Artifacts
- Media and technology sources

TN Social Studies Standard 6.18

Analyze the achievements of ancient Egyptian civilization, including: hieroglyphics, papyrus, and the pyramids and Sphinx at Giza.

Objectives:

Students will already have been studying Egypt in their classroom. This lesson will introduce hieroglyphics, allow them to create their own stamp with the 3D printer, and then use their stamp to create an Egyptian clay cartouche. At the end of the project, students will complete a short exit questionnaire explaining their chosen symbols, the art skills they worked on, and their favorite part of the project.

This 3-D printing project is designed to be an early effort in student design, rather than a student download of a predesigned project. Additionally, students will not complete their final artwork with the 3-D printer. Instead, the printer is used to create a tool they will use to complete an artwork with traditional clay.

Math skills developed in this project include measuring lengths and determining size, using reflections of images, and exploring the 3 dimensional nature of cubes (because a stamp can be placed on each side of the cube). Technology skills include understanding how to access and modify different surfaces in a 3-D image, how to group pieces of a project into one object, and using a 3-D printer. Social studies concepts include the study of a cartouche in ancient Egypt culture and afterlife beliefs.

Materials Required:

- 3D Printer with ABS spool
- Computer or Chromebook to run your choice of design software
- 3D Design Software (This Lesson Plan references Tinkercad)
- Air dry Clay or oven baked Polymer Clay (Sculpey/FIMO) (Day 2)

Introduction:

Egyptians used a written language in order to communicate information about the person presented on a sculpture or relief. They believed the written language was given to them by one of their gods, Thoth. Their language contained consonants only, no vowels and contained more than 7000 symbols. Some symbols were rarely used, however, and others were never pronounced out loud but clarified the meaning of a symbol. Hieroglyphs were used until the 4th century AD, after which the spread of Christianity brought an alphabetic script.

The Hieroglyphic Alphabet chart contains a simplified alphabet which does include vowels and may be printed out to show students examples of written language. This will also allow them to be able to write their name in hieroglyphics.

Questions for students:
- What do you notice about these symbols?
- Are there any repeated hieroglyphics?
- How many different kinds of animals are there?

- What do you notice about the symbol for "X"? Why would this combination come to be?
- Why should the image on your stamp be created backwards?

Procedure:

Day 1:

Students will work in teams of 2 (or individually if there are enough computers) in order to create the data files for the 3D printers. However, each student should create his or her own stamp. Students should obtain a computer for each group and then login to Tinkercad. If students have not used Tinkercad before the teacher may include a Tinkercad play day by using the tutorial at the end of this lesson plan in order to create a simple star stamp and become familiar with the Tinkercad tools.

The included Tinkercad instructions may be printed out for students as a reference, but the intent is for the students to follow the teacher's lead as he/she shows them how the design is created using the classroom projection tools.

Teachers have the option of letting students place a different hieroglyphic on each side of the stamp cube. Alternatively, students may be assigned different hieroglyphic letters with the teacher printing out multiple copies of each glyph corresponding to classroom needs.

How to Make a 3-D Printed Stamp (30 to 45 minutes)

1. Start your new design with a simple red box in the middle of your workspace.
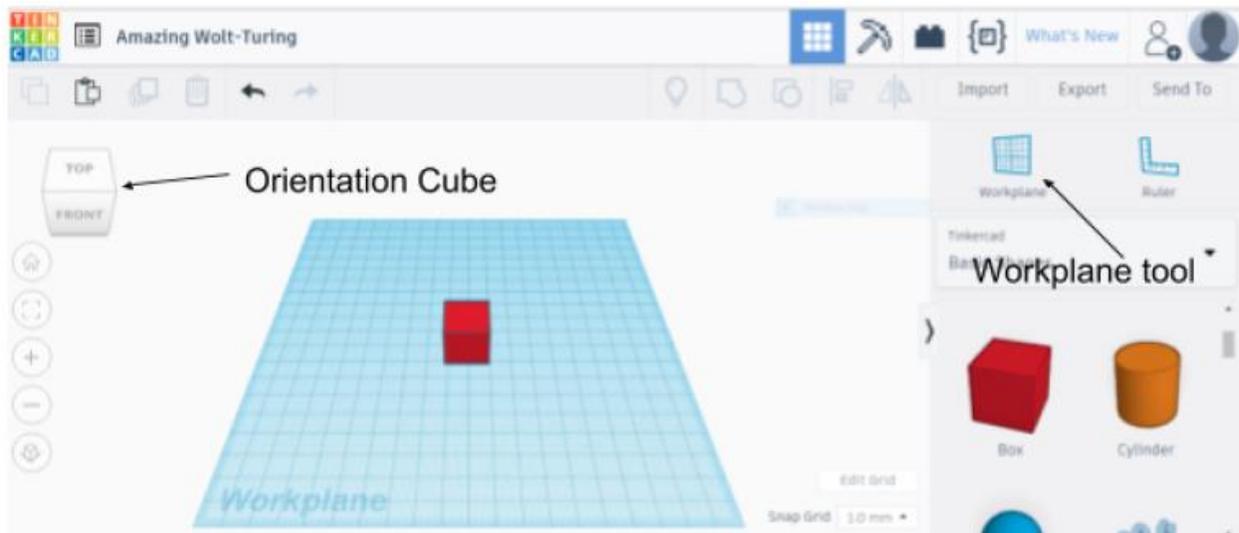

2. Change the size of the box to a size you like between 20 mm and 30 mm on each side.
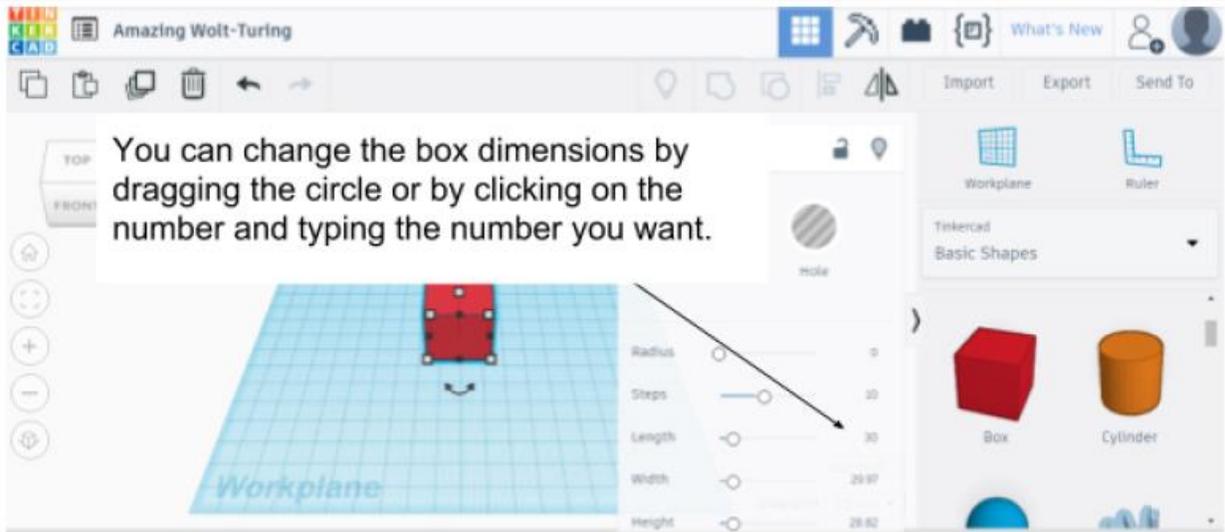
3. Use the orientation box to move the top of the box toward you.
4. Drag a work plane to the side facing you.
   a. Remember: when you drag a new shape to your design, it will be placed on the work plane. If you want the shape to be on the top of your box, the work plane needs to be on top of your box.
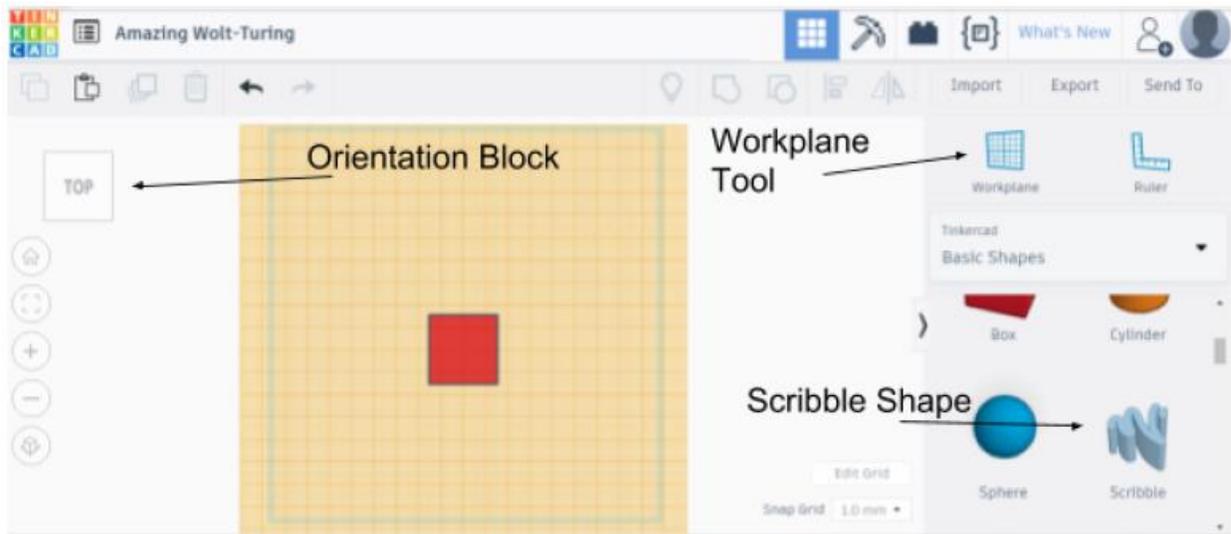

5. Drag the scribble shape to the workspace.
   a. You may have to scroll down in the shapes area.
   b. A new screen will open up where the students will be able to draw their hieroglyphics
6. Draw the shape you want for your stamp. Use the shapes on the handouts for inspiration.
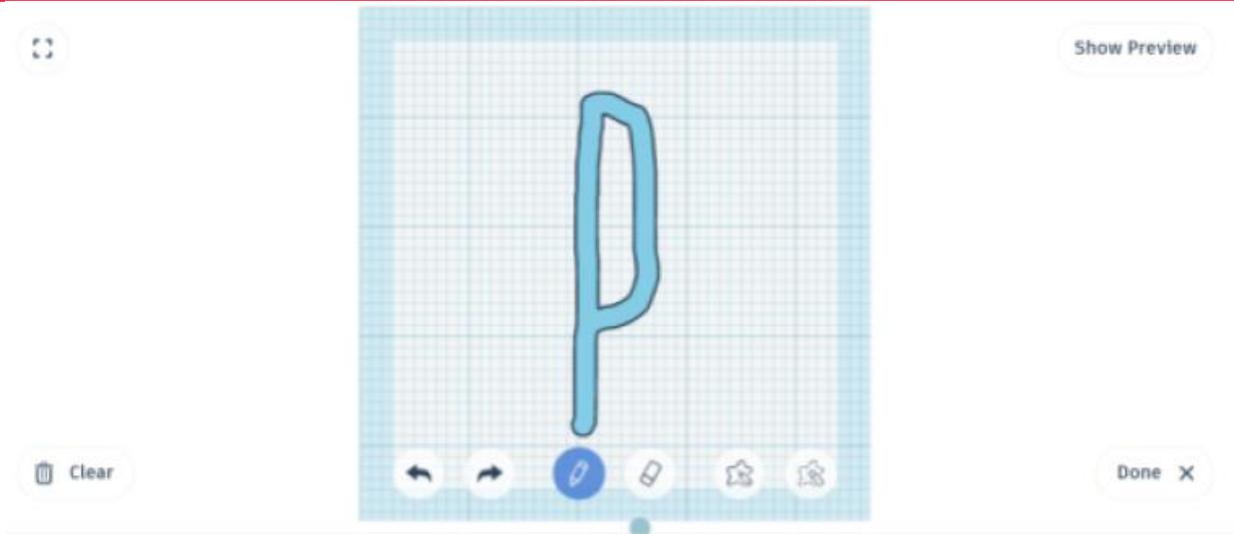
7. Click done when you are happy with your shape.
   a. The drawing screen disappears and you now see the original red box with your scribble as well.
8. Resize the scribble so that it fits on your box by dragging one of the white corner squares.
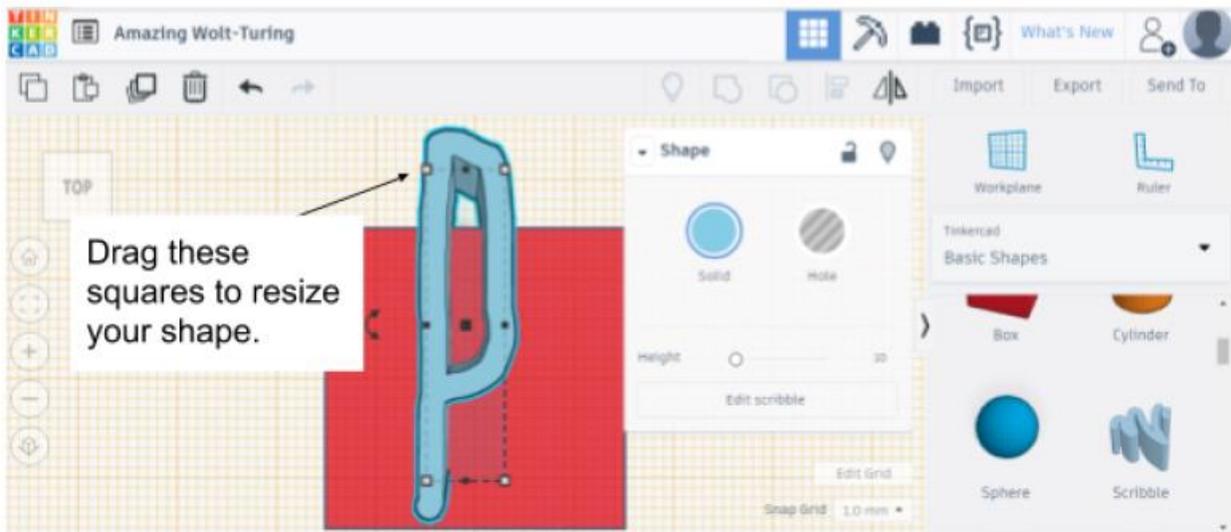
9. Flip the scribble so that it is the correct orientation when stamped.
   a. Click on the flip tool to the upper right of the work area.
   b. Click on the horizontal arrows (pointing left and right) under your scribble.
   c. Your scribble should be flipped so that it appears backwards on your stamp.

Flip Tool

Flip Direction
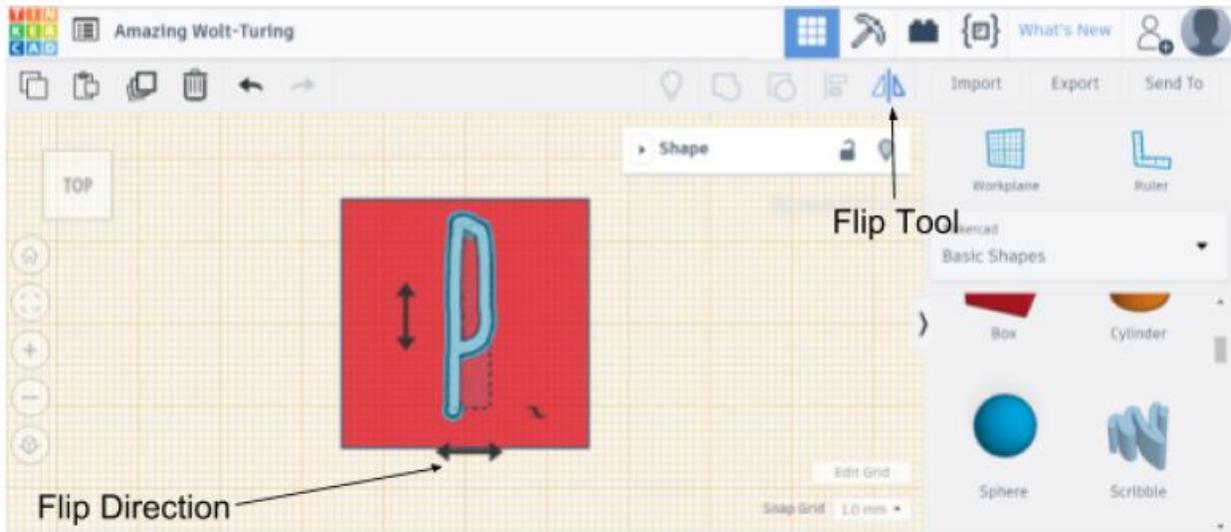
10. Draw a box around both shapes to select them and use the "Group" tool to make the 2 objects one.

Group Tool
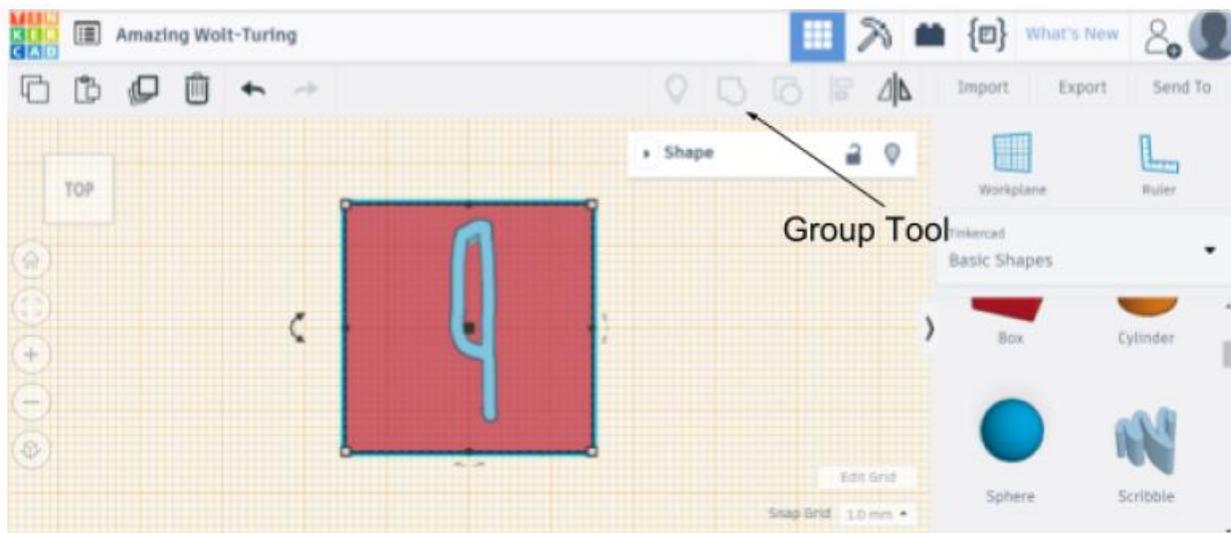
11. If there is time, choose another surface and add another hieroglyphic.
12. Click Export, name your project, and choose ".obj" for 3d printing.
13. Print the stamp according to instructions for the printer.

Differentiation:
       Students who struggle with the scribble tool may use the given shapes to make their stamp or by using the English letters. These can be found in the "Tinkercad Basic Shapes" dropdown menu under Text and Numbers.
       Hieroglyphic alphabet characters can also be added to Tinkercad using the instructions found in the Egyptian Cartouche Toolkit at the link in the references.
       Additionally, teachers may create the base stamp with scribbles on each side for

students and assign the students to edit the scribble design only. This can be accomplished by importing an obj file from the hard drive or by sharing the object on the Tinkercad website.

Accelerated students may want to create a rolling stamp, using the cylinder shape as a base rather than a box. Note that the cylinder is not perfectly round in Tinkercad. Rather, it has 12 vertical sides which will each need to have their own work plane assigned in order to attach the scribble shape. They may also be challenged to research hieroglyphics on their own to come up with different or original hieroglyphic designs.

Closure

Today we learned how the ancient Egyptians used written language to communicate. We also made stamps of Egyptian hieroglyphics. Next time, we will use these stamps as tools to help us create our own Egyptian cartouches.

Reflect on today's work:
- Who can tell us which school subjects we might have been using today? Language? Math? History? Art?
- What is the name of the ancient Egyptian system of writing?
- Why is written communication important?

Procedure for Day 2:

Introduction:

Last time we met, you designed a stamp for us to use today. These stamps are now ready to be used with our clay for you to make your very own hieroglyphic carving: a cartouche.

Procedure (20 - 30 minutes):

Starting with a small ball of clay, students will flatten and roll clay out to approximately ¼ inch thickness. Using a template provided by the teacher, students will trace and cut out their cartouche shape. Students will use their 3-D printed hieroglyph stamps to imprint images in the clay to form their names on the cartouche shape. If using air dry clay, it will be set aside to dry for several days. Upon completely drying, tempera or acrylic paints may be used to add additional designs.

If using polymer clay, a hole can be placed at the top of the cartouche prior to baking in the oven. Once hardened by exposure to the oven heat, the cartouche may be painted, given the addition of a string and worn as a necklace.

Differentiation:

Younger students who struggle with flattening and rolling out an even ¼ inch clay slab may be given a pre-formed slab provided by the teacher. Additionally, teachers may create the cut out of the cartouche and provide the students with a shape that is ready to imprint.

Accelerated students may want to create 3-D clay forms such as boxes, vases, or copic jars rather than using a flat clay slab as the base for their imprinted hieroglyphs. If

a rolling stamp was created, students may wish to imprint the entire surface of their form using this device.

Closure (10 - 15 minutes)

Today we created a clay cartouche which used your 3-D printed stamp from last time. The ancient Egyptians used a cartouche to tell information about themselves to other people. Your cartouche also tells other people about you. Think about the work we completed while you fill out the Checkout Sheet.

Assessment:

Students may be assessed by their answers on the Checkout Sheet and by their work on the stamp and the cartouche. Is the work neat? Did the hieroglyphic fit properly on the stamp block? Are the images clear and similar to the intent on the handout?

Grading Rubric

Did student successfully design a 3-D printed stamp with hieroglyphics on at least one side?
0 1 2 3 4

Is the student able to identify and describe at least 2 subject areas which were used in this project?
0 1 2 3 4

Is the student able to describe the purpose of hieroglyphics?
0 1 2 3 4

Did the student successfully complete the clay cartouche?
0 1 2 3 4

Is the student able to describe successful completion and points for improvement?
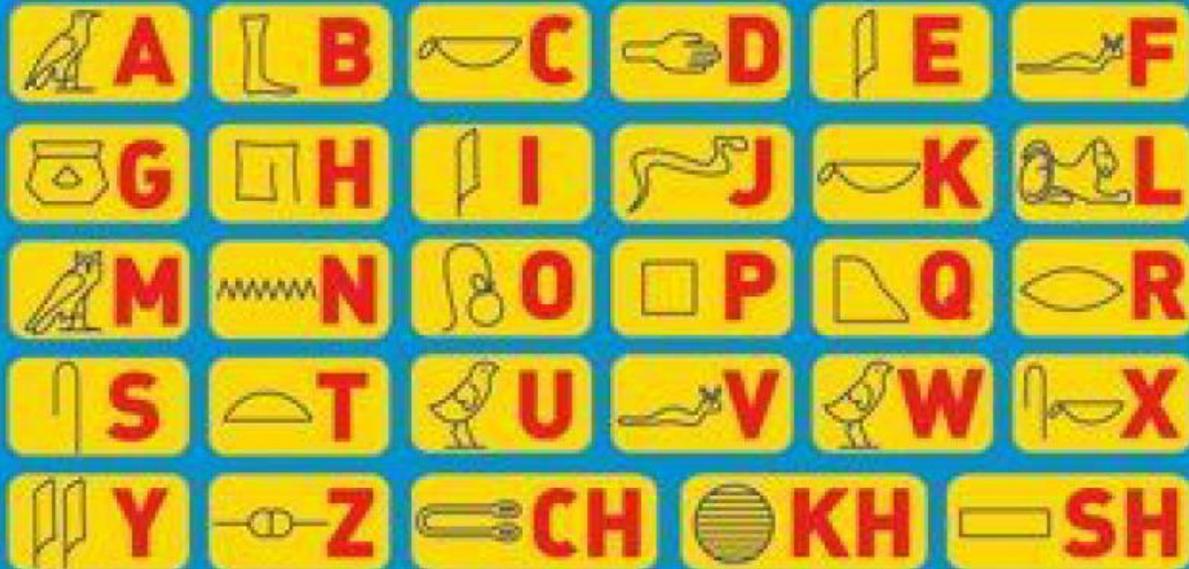0 1 2 3 4

Key:
0 - Not at all
1 - Yes, poorly
2 - Yes, to a satisfactory degree
3 - Yes, to a good degree
4 - Yes, to a high degree

HIEROGLYPHIC ALPHABET

Clay Cartouche   Checkout Name_____

What is an art "medium?"

I utilized a 3-D printer as a "medium" for creating art.
Yes, Somewhat, No…. Explain your answer.

Which of the subjects you study in school (math, science, language, social studies, art)
were used in this project? Explain.

Why might it be helpful to create hieroglyphics with stamps rather than a hammer and
chisel?

Why might it be better to use a hammer and chisel rather than a stamp?

Describe an interesting fact about Egyptian history or culture that you learned.
Why was it necessary to flip your hieroglyphic image before printing it?

Overall, I think my stamp and cartouche are successful because…

If you were to do these two creative activities again, what things would you do
differently?

References

The British Museum.
http://www.britishmuseum.org/pdf/Visit_Egypt_Symbols_KS2.pdf

National Geographic Kids
https://www.natgeokids.com/au/discover/history/egypt/hieroglyphics-uncovered/

Tinkercad 3D Design Copy of Egyptian Cartouche Toolkit
https://www.tinkercad.com/things/iIhbYEkNLo2-copy-of-egyptian-cartouche-
hieroglyphs-construction-kit/editv2

Tennesee State Education Standards
https://www.tn.gov/content/dam/tn/stateboardofeducation/documents/Fine_Arts_St
andards_2016_FINAL.pdf

https://www.tn.gov/content/dam/tn/education/standards/math/stds_math.pdf

https://www.tn.gov/content/dam/tn/stateboardofeducation/documents/massivemeeti
ngsfolder/meetingfiles4/7-28-
17_IV_C_Social_Studies_Standards_Attachment_REVISED_7-28.pdf

Tinkercad Newbie Tutorial

Estimated time required: 30 minutes to 1 hour

This tutorial will show students how to make a star stamp. The teacher should already be comfortable with the tinkercad software and will guide students through this mini-tutorial on his/her classroom projector.

1. Goto www.tinkercad.com
2. Click on the "Signup" button in the upper right hand corner.
3. Follow the steps to create an account.
   a. Schools may choose to do this step for the students and simply give the studenta username and password. It is advised that students each have their own username and password in order to enable them to refer to work they have already completed.
4. Login to your Tinkercad account.
5. Open a new project by clicking on "Make New Design"
6. When a blue grid workspace appears, drag a box (it is red and on the right hand side of the screen under "Basic Shapes") near to the center of the workspace. Scroll down in the section where you found the box to see other shapes that are available.
7. Use the box in the upper left corner to view your box from all sides. Twist it and turn it until you see the top, bottom, left, right, back, and front.
8. Click on the red box. Notice the black squares. Drag the black squares to change the size of the red box. Make the red box 30 mm high, 30 mm across, and 30 mm deep.
   a. You will have to move the orientation box until you can see all three dimensions.
   b. Notice the numbers that change as you drag the black squares. This tells you the length of the side of the box you are changing.
9. Move the box until you are looking at the very top of your red box.
10. Drag the workplane to the center of the top of your box.
    a. This lets you add shapes to the top of the box.

11. Scroll down in your shapes until you find the yellow start. Drag the yellow star to the top of the red box.

12. Resize the star using the white squares on the corner. It should fit on the top of the box. Use the arrow keys to re-center the star on the red box.

13. Use the orientation box to turn the box so you are looking at one of the sides of the box. Click on the yellow star. Hover over the middle white square until you see the height of the yellow star. Drag that white box down until it is 5 mm tall.

14. Drag a new workspace to the bottom of the red box.

15. Click anywhere on the work space away from your model.

16. Drag the mouse to create a box around both the star and the cube.

17. Click on the "Group" tool in the tool bar.

18. Click on "Export" and choose ".obj" for your 3D Printer.

19. The file is now ready to be printed.