3D STEAM

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Modeling the Ancient Great Sphynx with 3D Printing

RELATED SUBJECTS	GRADE RECOMMENDATIONS	TOTAL ACTIVITY TIME	LEARNING OBJECTIVES DURING THE LESSON SUBJECT-SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON
History, Mathematics, Technology, Arts	Grades 6-8 (Ages 11-14)	135 minutes (3 lessons of 45 minutes each)	- Understand historical and cultural significance of the Great Sphinx. - Calculate accurate dimensions for scale modeling. - Learn and apply digital modeling skills using Tinkercad.	- Strengthen historical knowledge, mathematical scaling techniques, and digital creation skills. - Foster continuous interest in using technology creatively for educational purposes.

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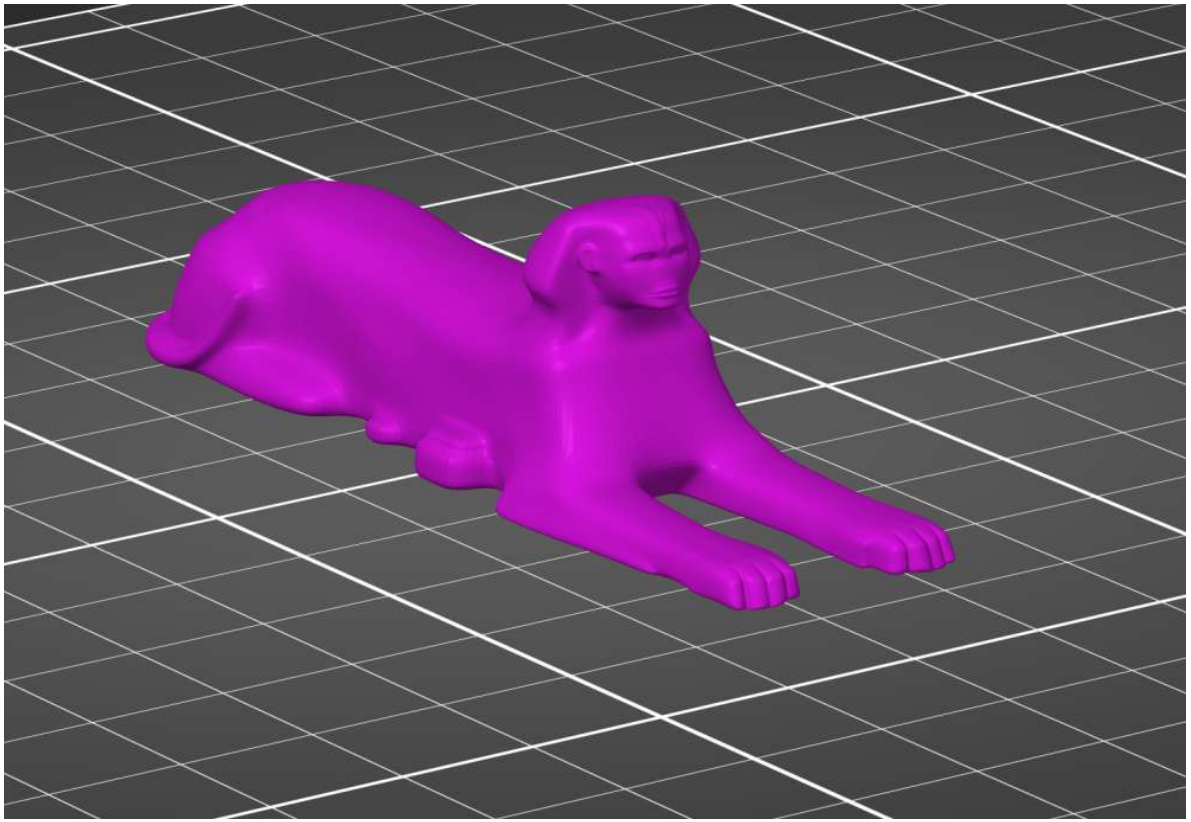

In this unit, students dive into ancient Egypt by digitally modeling and 3D printing a detailed miniature of the Great Sphinx. Through integrated history, mathematics, technology, and arts

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activities, students enhance their understanding of ancient cultures and acquire practical digital fabrication skills.

- Basic historical knowledge about ancient Egypt, specifically the pyramids and the Sphinx.
- Fundamental skills in measurements, scales, and basic geometry.

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3D Modelling and 3D Printing Integration

3D MODELING TOOLS AND SOFTWARE:	Tinkercad (digital modeling), Craftware Pro or Cura (slicing software)
3D PRINTING PROCESS:	Students design their digital models in Tinkercad, export as STL files, slice the models using Craftware Pro or Cura, and finally print them on a 3D printer using PLA filament.
LEARNING OBJECTIVES RELATED TO 3D MODELING AND PRINTING:	- Precision in digital modeling and scaling. - Practical understanding and hands-on experience with the 3D printing workflow.

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STEAM Elements

STEAM SUBJECTS	SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATHEMATICS
SHORT INTRODUCTION TO RELATED SUBJECT ELEMENTS	Exploring material properties and structural integrity in 3D printing.	Utilizing digital modeling and slicing software effectively.	Planning and executing precise digital-to-physical 3D printed models.	Creating aesthetically pleasing and historically accurate representations.	Applying measurements, geometric principles, and accurate scaling.

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Syllabus

LESSONS	SUBJECTS	TOPIC OF THE UNIT	LEARNING OBJECTIVES DURING THE LESSON: SUBJECT-SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON: STEAM COMPETENCIES
1	History, Mathematics	**The Great Sphinx: History and Geometry** Explore the origins and cultural significance of the Great Sphinx, and identify its geometric features.	Understand the historical and cultural significance of the Great Sphinx of Giza • Recognize and describe the basic geometric forms found in the Sphinx's structure • Begin basic scaling by estimating proportional relationships	- Connect historical knowledge with geometric thinking Develop foundational spatial reasoning through real-world cultural contexts Build cross-disciplinary thinking by linking history and math
2	Mathematics, Technology	**From Monument to Model: Scaling and Design Planning** Learn how to calculate scaled dimensions of the Sphinx and plan a digital model.	- Calculate and convert real-world dimensions into scaled proportions for modeling • Use simple math operations (ratios, measurements) to prepare for 3D design • Draft a basic plan or sketch of the model based on geometric interpretation	- Apply math in a practical design scenario Strengthen numeracy through scale conversion Use technology as a tool for design planning
3	Technology, Arts, Engineering	**Modeling and Presenting the Sphinx**	- Digitally model the Sphinx using basic shapes and tools in Tinkercad	- Develop 3D modeling and basic engineering skills

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		Digitally model the Sphinx in Tinkercad and prepare for a class exhibition.	• Prepare the model for printing by exporting and adjusting print settings • Present the final model concept and reflect on the process	□ Express creativity through aesthetic decisions in the digital design □ Communicate design ideas effectively and reflect on interdisciplinary learning

Instructional Plan by Lesson

(Copy this section as many times as needed for each lesson)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS (SOFTWARE, HARDWARE)	LEARNING OBJECTIVES
INTRODUCTION (5 MINUTES)	Introduce the Sphinx with photos/videos. Ask: *"Why has the Sphinx fascinated people for centuries?"* and preview the unit goal.	- Slides or short video on Ancient Egypt □ Printed images of the Sphinx □ Whiteboard	□ - Understand the cultural and historical importance of the Great Sphinx □ Spark student curiosity about ancient engineering
LEARNING ACTIVITIES (20 MINUTES)	□ - Mini lecture on the Sphinx (location, materials, mythology) □ Geometry analysis of the monument (base shape, symmetry, proportions)	□ - Geometry reference handout □ Worksheets for sketching □ Rulers, pencils	□ - Identify and analyze geometric shapes in historical architecture □ Develop geometric reasoning tied to historical context

	□ Students sketch the Sphinx using basic geometric shapes		
3D MODELLING ACTIVITIES (10 MINUTES)	Teacher demonstrates Tinkercad interface: basic shapes, movement, rotation. Students begin placing base shapes for the Sphinx.	□ - Computer/projector □ Tinkercad online □ Student laptops or desktops	□ - Gain familiarity with digital modeling tools □ Begin rough layout of their model based on their sketch
3D PRINTING ACTIVITIES (X MINUTES)	-	-	-
WRAP-UP & EVALUATION (10 MINUTES)	□ - Students complete a reflection: *"What part of the Sphinx was hardest to draw or model?"* □ Share answers in pairs or groups		□ - Reflect on the challenges of visual-to-digital translation □ Build confidence in modeling process

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS (SOFTWARE, HARDWARE)	LEARNING OBJECTIVES
INTRODUCTION (5 MINUTES)	Recap previous lesson. Pose key question: *"If the Sphinx is 73*	- Sphinx dimensions visual Whiteboard with ratio example	- Connect real-world dimensions to mathematical scaling

	meters long, how big should our model be?"		
LEARNING ACTIVITIES (20 MINUTES)	□ - Students receive real Sphinx dimensions and convert them into scale (e.g., 1:1000) □ Work in pairs to solve ratio problems □ Fill in modeling dimension planning sheet	□ Calculators or tablets	□ - Use ratio and scale to prepare accurate digital models □ Strengthen practical math skills in a design context
3D MODELLING ACTIVITIES (15 MINUTES)	Students return to Tinkercad and apply scaled measurements to their models (e.g., resizing base, aligning parts)	□ - Tinkercad □ Student computers	□ - Apply scaling from worksheet to CAD environment □ Refine model accuracy with correct dimensions
3D PRINTING ACTIVITIES (X MINUTES)	-	-	-
WRAP-UP & EVALUATION (5 MINUTES)	□ - Students compare their model sizes □ Quick gallery walk (screen share or desk walk) to see how others applied scaling	□ - Peer feedback sheet □ Teacher rubric (informal)	□ - Reinforce visual-spatial awareness and accuracy □ Peer evaluation of model size and proportion

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS (SOFTWARE, HARDWARE)	LEARNING OBJECTIVES
INTRODUCTION (5 MINUTES)	Present today's goal: finish the Sphinx model and prepare it for printing Question: "What do you want your final model to show or represent?"	- Slide with model examples Prompt questions for goal setting	- Set intention and artistic vision for the final model
LEARNING ACTIVITIES (10 MINUTES)	Students plan final details: artistic features, symmetry check, component positioning Quick checklist to guide their finishing process	- Finishing checklist Printed reference photos of the Sphinx	- Evaluate and improve digital work with a critical eye Plan artistic and structural enhancements
3D MODELLING ACTIVITIES (15 MINUTES)	Students complete their Tinkercad model. Export STL files with teacher assistance. Rename files and prepare them for slicing.	- Tinkercad Student devices	- Finalize digital model with full geometry and scaled dimensions Learn file preparation workflow
3D PRINTING ACTIVITIES (10 MINUTES)	Demonstrate slicing software (e.g., Cura or Craftware). Students slice their files, choose print settings (scale, infill), and preview the layer-by-layer print.	- 3D printer and slicer Sample sliced files	- Understand slicing process for 3D printing Prepare their model for successful physical fabrication

WRAP-UP & EVALUATION (5 MINUTES)	Students write or discuss: *“What did I learn about combining art, math, and tech?”* Optional: vote on class models for categories like "Most Precise", "Most Creative"	- Evaluation sheet	- Reflect on interdisciplinary learning Recognize challenges and triumphs in the design process

Evaluation Plan by Lesson

LESSON	EVALUATION CRITERIA	EVALUATION METHOD	3D MODELING AND PRINTING ASSESSMENT:
1	*Does the student understand the historical and cultural significance of the Great Sphinx?* *Can the student recognize and describe basic geometric shapes within the Sphinx structure?*	*- Concept map activity on Ancient Egypt and the Sphinx* • *Group discussion and sketch-based worksheet* • *Observation during geometry sketching and modeling prep*	*- Evaluate sketches of the Sphinx using a checklist:* • *Are basic geometric forms identified (cylinder, prism, pyramid)?* • *Are features like paws, head, and base properly placed in the drawing?* *Review of initial Tinkercad layout: proper object placement and grouping of basic shapes*
2	*Did the student successfully calculate and apply correct scale measurements for modeling?* *Can the student transfer calculated dimensions to their digital model?*	*- Accuracy check of scale worksheets* • *Observation of student work during modeling* • *Peer review of initial scaled models using a quick evaluation checklist*	*- Tinkercad model evaluated for:* • *Application of proper scaling (matching the 1:x ratio from real-world measurements)* • *Proportional relationships between components (e.g., body to head, base size)* • *Correct use of alignment tools and uniform scaling across parts*

3	*Is the student able to complete and present a digital 3D model that reflects scaled geometry and artistic interpretation?* *Can the student explain the modeling and printing process confidently?*	*- Observation of final modeling process* • *Student presentation or written reflection explaining design choices* • *Peer review of models and presentations*	□ *- Final model is assessed for:* • *Accuracy and completeness of structure* • *Aesthetic details and creativity (e.g., facial features, stylized base)* • *Model is export-ready: properly grouped, oriented for printing, no floating parts* □ *Sliced file preview reviewed for correctness (layer view, support generation, orientation)*

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Additional Resources

NOTES:

ACTIVITY SHEETS TO BE LINKED:

EVALUATION MATERIALS TO BE LINKED:

REFERENCES / SUPPORTING MATERIALS TO BE LINKED:

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