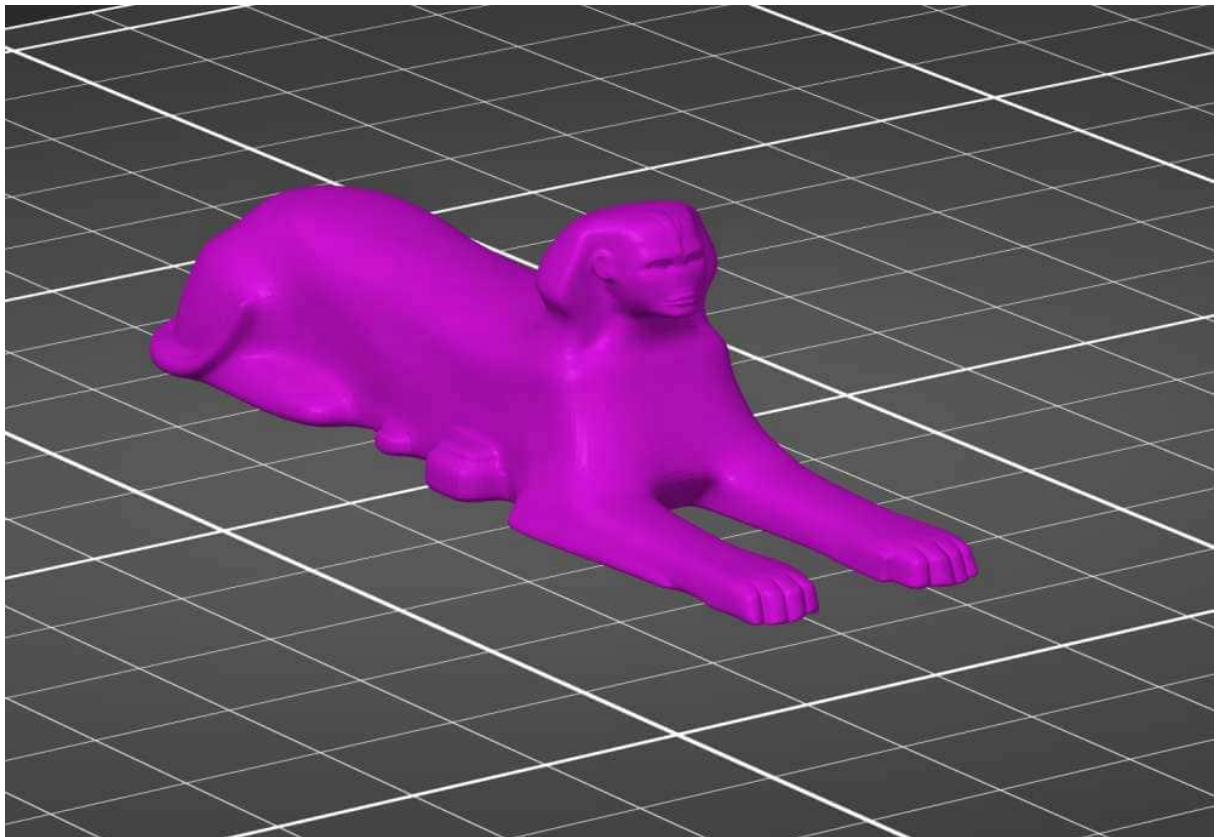


## ACTIVITY 06

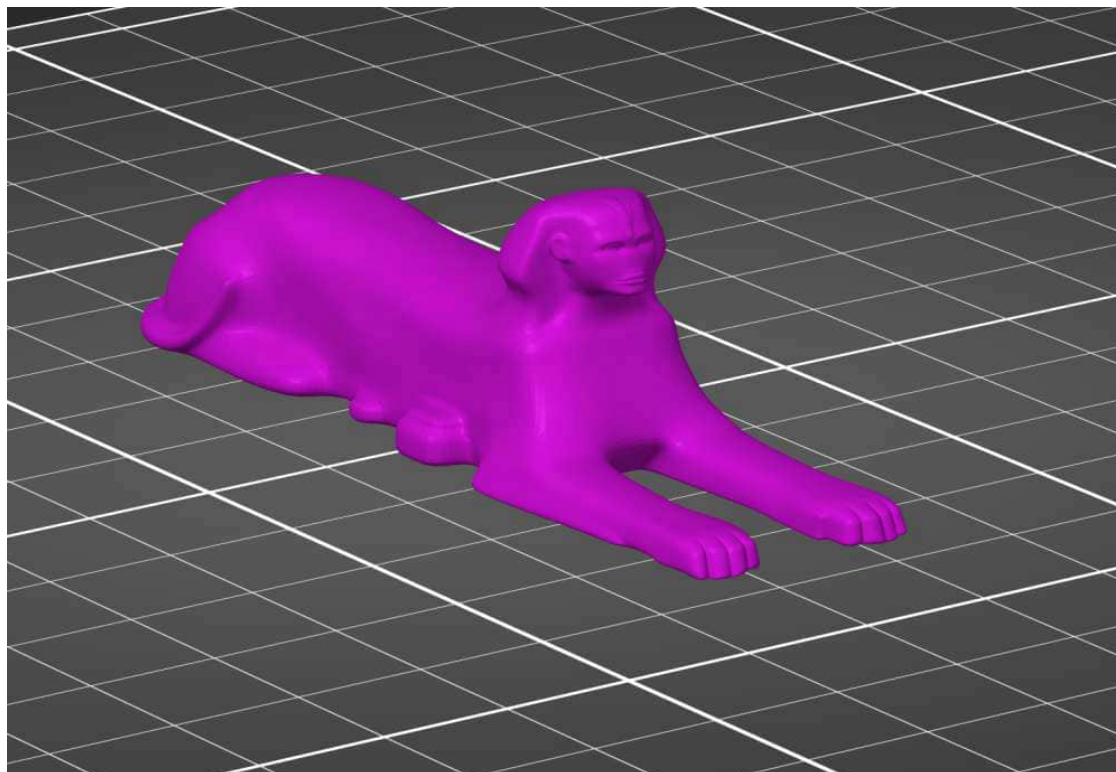
# Modeling the Ancient Great Sphynx



*Illustration from the activity*

## Modeling the Ancient Great Sphynx with 3D Printing

| RELATED SUBJECTS                       | GRADE RECOMMENDATIONS   | TOTAL ACTIVITY TIME                        | LEARNING OBJECTIVES DURING THE LESSON<br>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) | <ul style="list-style-type: none"> <li>- Understand historical and cultural significance of the Great Sphinx.</li> <li>- Calculate accurate dimensions for scale modeling.</li> <li>- Learn and apply digital modeling skills using Tinkercad.</li> </ul> | <ul style="list-style-type: none"> <li>- Strengthen historical knowledge, mathematical scaling techniques, and digital creation skills.</li> <li>- Foster continuous interest in using technology creatively for educational purposes.</li> </ul> |



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



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.



## 3D Modelling and 3D Printing Integration

|                                                                             |                                                                                                                                                                                          |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3D MODELING TOOLS<br/>AND SOFTWARE:</b>                                  | Tinkercad (digital modeling), Craftware Pro or Cura (slicing software)                                                                                                                   |
| <b>3D PRINTING PROCESS:</b>                                                 | 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.         |
| <b>LEARNING OBJECTIVES<br/>RELATED TO 3D<br/>MODELING AND<br/>PRINTING:</b> | <ul style="list-style-type: none"> <li>- Precision in digital modeling and scaling.</li> <li>- Practical understanding and hands-on experience with the 3D printing workflow.</li> </ul> |

## STEAM Elements

| STEAM<br>SUBJECTS                                          | SCIENCE                                                                | TECHNOLOGY                                                   | ENGINEERING                                                           | ARTS                                                                       | MATHEMATICS                                                        |
|------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------|
| SHORT<br>INTRODUCTION<br>TO RELATED<br>SUBJECT<br>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. |

## 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          | <b>The Great Sphinx: History and Geometry</b><br>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 <ul style="list-style-type: none"> <li>Recognize and describe the basic geometric forms found in the Sphinx's structure</li> <li>Begin basic scaling by estimating proportional relationships</li> </ul>             | <input type="checkbox"/> - Connect historical knowledge with geometric thinking<br><input type="checkbox"/> Develop foundational spatial reasoning through real-world cultural contexts<br><input type="checkbox"/> Build cross-disciplinary thinking by linking history and math |
| 2       | Mathematics, Technology       | <b>From Monument to Model: Scaling and Design Planning</b><br>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 <ul style="list-style-type: none"> <li>Use simple math operations (ratios, measurements) to prepare for 3D design</li> <li>Draft a basic plan or sketch of the model based on geometric interpretation</li> </ul> | <input type="checkbox"/> - Apply math in a practical design scenario<br><input type="checkbox"/> Strengthen numeracy through scale conversion<br><input type="checkbox"/> Use technology as a tool for design planning                                                            |
| 3       | Technology, Arts, Engineering | <b>Modeling and Presenting the Sphinx</b>                                                                                                                | - Digitally model the Sphinx using basic shapes and tools in Tinkercad                                                                                                                                                                                                                               | <input type="checkbox"/> - Develop 3D modeling and basic engineering skills                                                                                                                                                                                                       |

|  |  |                                                                             |                                                                                                                                                                                                    |                                                                                                                                                                                                          |
|--|--|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | Digitally model the Sphinx in Tinkercad and prepare for a class exhibition. | <ul style="list-style-type: none"> <li>• Prepare the model for printing by exporting and adjusting print settings</li> <li>• Present the final model concept and reflect on the process</li> </ul> | <input type="checkbox"/> Express creativity through aesthetic decisions in the digital design<br><input type="checkbox"/> 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: <i>"Why has the Sphinx fascinated people for centuries?"</i> and preview the unit goal.                                                    | - Slides or short video on Ancient Egypt<br><input type="checkbox"/> Printed images of the Sphinx<br><input type="checkbox"/> Whiteboard               | <input type="checkbox"/> - Understand the cultural and historical importance of the Great Sphinx<br><input type="checkbox"/> Spark student curiosity about ancient engineering |
| LEARNING ACTIVITIES (20 MINUTES) | <input type="checkbox"/> - Mini lecture on the Sphinx (location, materials, mythology)<br><input type="checkbox"/> Geometry analysis of the monument (base shape, symmetry, proportions) | <input type="checkbox"/> - Geometry reference handout<br><input type="checkbox"/> Worksheets for sketching<br><input type="checkbox"/> Rulers, pencils | <input type="checkbox"/> - Identify and analyze geometric shapes in historical architecture<br><input type="checkbox"/> Develop geometric reasoning tied to historical context |



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

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

|                                      |                                                                                                                                                                                                                                                       |                                                                                                      |                                                                                                                                                                    |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | <i>meters long, how big should our model be?"</i>                                                                                                                                                                                                     |                                                                                                      |                                                                                                                                                                    |
| LEARNING ACTIVITIES (20 MINUTES)     | <input type="checkbox"/> - Students receive real Sphinx dimensions and convert them into scale (e.g., 1:1000)<br><input type="checkbox"/> Work in pairs to solve ratio problems<br><input type="checkbox"/> Fill in modeling dimension planning sheet | <input type="checkbox"/> Calculators or tablets                                                      | <input type="checkbox"/> - Use ratio and scale to prepare accurate digital models<br><input type="checkbox"/> 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)                                                                                                                                      | <input type="checkbox"/> - Tinkercad<br><input type="checkbox"/> Student computers                   | <input type="checkbox"/> - Apply scaling from worksheet to CAD environment<br><input type="checkbox"/> Refine model accuracy with correct dimensions               |
| 3D PRINTING ACTIVITIES (x MINUTES)   | -                                                                                                                                                                                                                                                     | -                                                                                                    | -                                                                                                                                                                  |
| WRAP-UP & EVALUATION (5 MINUTES)     | <input type="checkbox"/> - Students compare their model sizes<br><input type="checkbox"/> Quick gallery walk (screen share or desk walk) to see how others applied scaling                                                                            | <input type="checkbox"/> - Peer feedback sheet<br><input type="checkbox"/> Teacher rubric (informal) | <input type="checkbox"/> - Reinforce visual-spatial awareness and accuracy<br><input type="checkbox"/> 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<br>Question: "What do you want your final model to show or represent?"                    | - Slide with model examples<br><br>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<br>Quick checklist to guide their finishing process                           | <input type="checkbox"/> - Finishing checklist<br><input type="checkbox"/> Printed reference photos of the Sphinx | <input type="checkbox"/> - Evaluate and improve digital work with a critical eye<br><input type="checkbox"/> Plan artistic and structural enhancements    |
| 3D MODELLING ACTIVITIES (15 MINUTES) | Students complete their Tinkercad model.<br>Export STL files with teacher assistance.<br>Rename files and prepare them for slicing.                                 | <input type="checkbox"/> - Tinkercad<br><input type="checkbox"/> Student devices                                  | <input type="checkbox"/> - Finalize digital model with full geometry and scaled dimensions<br><input type="checkbox"/> Learn file preparation workflow    |
| 3D PRINTING ACTIVITIES (10 MINUTES)  | Demonstrate slicing software (e.g., Cura or Craftware).<br>Students slice their files, choose print settings (scale, infill), and preview the layer-by-layer print. | <input type="checkbox"/> - 3D printer and slicer<br><input type="checkbox"/> Sample sliced files                  | <input type="checkbox"/> - Understand slicing process for 3D printing<br><input type="checkbox"/> Prepare their model for successful physical fabrication |

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

## Evaluation Plan by Lesson

| LESSON | EVALUATION CRITERIA                                                                                                                                                                                              | EVALUATION METHOD                                                                                                                                                                                                            | 3D MODELING AND PRINTING ASSESSMENT:                                                                                                                                                                                                                                                                                                                                                                             |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | <p><i>Does the student understand the historical and cultural significance of the Great Sphinx?</i></p> <p><i>Can the student recognize and describe basic geometric shapes within the Sphinx structure?</i></p> | <p>- Concept map activity on Ancient Egypt and the Sphinx</p> <ul style="list-style-type: none"> <li>Group discussion and sketch-based worksheet</li> <li>Observation during geometry sketching and modeling prep</li> </ul> | <p><input type="checkbox"/> - Evaluate sketches of the Sphinx using a checklist:</p> <ul style="list-style-type: none"> <li>Are basic geometric forms identified (cylinder, prism, pyramid)?</li> <li>Are features like paws, head, and base properly placed in the drawing?</li> </ul> <p><input type="checkbox"/> Review of initial Tinkercad layout: proper object placement and grouping of basic shapes</p> |
| 2      | <p><i>Did the student successfully calculate and apply correct scale measurements for modeling?</i></p> <p><i>Can the student transfer calculated dimensions to their digital model?</i></p>                     | <p>- Accuracy check of scale worksheets</p> <ul style="list-style-type: none"> <li>Observation of student work during modeling</li> <li>Peer review of initial scaled models using a quick evaluation checklist</li> </ul>   | <p>- Tinkercad model evaluated for:</p> <ul style="list-style-type: none"> <li>Application of proper scaling (matching the 1:x ratio from real-world measurements)</li> <li>Proportional relationships between components (e.g., body to head, base size)</li> <li>Correct use of alignment tools and uniform scaling across parts</li> </ul>                                                                    |

|   |                                                                                                                                                                                                                              |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | <p><i>Is the student able to complete and present a digital 3D model that reflects scaled geometry and artistic interpretation?</i></p> <p><i>Can the student explain the modeling and printing process confidently?</i></p> | <p>- Observation of final modeling process</p> <ul style="list-style-type: none"> <li>• Student presentation or written reflection explaining design choices</li> <li>• Peer review of models and presentations</li> </ul> | <p><input type="checkbox"/> - Final model is assessed for:</p> <ul style="list-style-type: none"> <li>• Accuracy and completeness of structure</li> <li>• Aesthetic details and creativity (e.g., facial features, stylized base)</li> <li>• Model is export-ready: properly grouped, oriented for printing, no floating parts</li> </ul> <p><input type="checkbox"/> Sliced file preview reviewed for correctness (layer view, support generation, orientation)</p> |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## Additional Resources

NOTES:

ACTIVITY SHEETS TO BE LINKED:

EVALUATION MATERIALS TO BE LINKED:

REFERENCES / SUPPORTING MATERIALS TO BE LINKED:





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