

# Who Owns the Pixels?

*Generative AI Tools, Creativity, and Authorship*





# Foreword

The urgency of preparing students for careers in science, technology, engineering, and mathematics (STEM) has never been greater. As an educator, you are pivotal in shaping the next generation of innovators who will address global challenges, including advancements in energy sciences and artificial intelligence. Your dedication and innovative teaching practices inspire students to explore impactful STEM fields and create solutions for our future.

At Pacific Northwest National Laboratory (PNNL), we are proud to support educators in fostering STEM learning. Through partnerships with the U.S. Department of Energy (DOE) Office of Science Workforce Development for Teachers and Scientists (WDTS), we provide resources and insights that empower you to prepare students for rewarding careers in STEM. The 2024 STEM Institute @ PNNL, a pilot of the WDTS Pathway Summer Institute program, exemplifies this commitment. This multi-week program brought middle and high school educators together with PNNL researchers and STEM professionals to explore real-world challenges and careers in Computational and Mathematical Sciences (CMS), particularly as they relate to energy sciences and artificial intelligence.

During the program, educators developed classroom activities designed to connect their teaching with cutting-edge challenges and career opportunities in CMS. Classroom activities developed by the summer 2024 educators focused on artificial intelligence, machine learning, and data science through the lens of computational and mathematical science. By integrating these activities into your classrooms, you not only strengthen students' computational and mathematical problem-solving abilities but also cultivate critical thinking, collaboration, and innovation. In addition, you are preparing students to navigate the transformative changes we are experiencing due to artificial intelligence/machine learning. These skills are vital in addressing future challenges and expanding pathways to careers in the energy sector, DOE, PNNL, and beyond.

This classroom activity was adapted by the Office of STEM Education and Workforce Development at PNNL from the classroom activity Ashley Peterson developed for middle and high school students to bridge STEM concepts with real-world applications.

Thank you for your unwavering commitment to STEM education. Your efforts extend far beyond the classroom; they are shaping future leaders and problem-solvers who will transform our world. We look forward to seeing how your students engage with and benefit from these activities, and we deeply value your partnership in advancing STEM learning. Together, we are driving education forward.

# Acknowledgement

The Pacific Northwest National Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC05-76RL01830. This work was supported by the Office of Workforce Development for Teachers and Scientists (WDTS) under the WDTS Pathway Summer Institute Program. We would like to acknowledge Jan Tyler, WDTS Program Manager, for her guidance and support throughout the 2024 pilot program. We are also appreciative of Ashley Peterson for their contributions and active participation in the development of this classroom activity. As part of the 2024 STEM Institute Cohort, we recognize and appreciate their leadership in designing interactive, inquiry-driven learning experiences that inspire students and elevate STEM education.

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# Classroom Activity Overview

In this classroom activity, students explore the societal implications and creative challenges of generating images with artificial intelligence (AI). Students use generative AI image tools such as Adobe Express or Google Gemini to engage in prompt engineering to replicate a designated AI-generated image. Through experimentation, refinement, and discussion, students examine key concepts such as authorship and responsible AI technology usage in digital art. This guide outlines the learning targets, tools, and instructions for STEM classroom activities. This activity connects scientific concepts to real-world applications and includes extension opportunities, enrichment ideas, and printable materials to support student interest and engagement.

## Assessments

Students will demonstrate understanding through:

- **Formative**
  - **Gallery Walk Notes** – Students review and reflect on their peers' work, highlighting notable creative approaches and effective prompt strategies.
- **Summative**
  - **AI Image Generation Activity** – Students refine prompts to replicate assigned images, analyze what worked well, and document adjustments for improvements.
  - **Reflection Prompts** – Students articulate a generative AI-related concern during image creation and discuss ownership and copyright issues related to AI-generated content.

## Learning Targets

By the end of this classroom activity, students will be able to:

1. Develop and apply effective prompts to guide AI image generation.
2. Reflect critically on creator responsibilities when using generative AI tools for creative purposes.
3. Examine ownership and copyright implications in AI-generated art.
4. Enhance technical skills through iterative generative art processes.

# Activity Snapshot

|                                      | Materials                                                                                                                                                                                                  | Educator Actions                                                                                                                                    | Student Actions                                                                                                                                                   |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Preparation</b><br>(5 min)        | Computers or tablets<br><br>AI image generation tool<br>Sample AI-generated images<br><br>Printed <b>AI Image Generation Activity</b> , <b>Reflection Prompts</b> , and <b>Gallery Walk Notes</b> handouts | Provide a tutorial on the AI generation tool and load sample images showcasing AI-generated images.                                                 | N/A                                                                                                                                                               |
| <b>Getting Started</b><br>(5–10 min) | Classroom display<br><br>Sample AI-generated images                                                                                                                                                        | Facilitate discussion.<br><br>Introduce the activity.                                                                                               | Observe AI-generated art.<br><br>Participate in a brief class discussion about societal implications.                                                             |
| <b>Activity</b><br>(30–40 min)       | Computers<br><br>AI image generation tool<br><br><b>AI Image Generation Activity</b>                                                                                                                       | Guide prompt refinement and technical exploration.<br><br>Support collaborative iteration processes.                                                | Use prompt engineering to replicate an assigned image.<br><br>Collaborate with a partner to refine prompts and analyze results.<br><br>Complete and display work. |
| <b>Wrap-up</b><br>(5–10 min)         | <b>Reflection Prompts</b><br><br><b>Gallery Walk Notes</b>                                                                                                                                                 | Lead a reflection discussion on responsible AI technology usage and ownership.<br><br>Encourage deeper debate about Adobe policies, if time allows. | Complete gallery walk.<br><br>Observe peers' work and reflect on societal and creative implications.                                                              |

# Activity Guide

## Preparation (Suggested Time: 5 min)

### Educator Actions

1. Set up computers or tablets with an AI image generation tool pre-installed and ready to use.
2. Provide a brief tutorial on how to access and navigate an AI image generation tool.
3. Ensure each group has a sample AI-generated image. Sources include Google searches, Adobe Firefly, and other generative platforms (e.g., Google Gemini, Microsoft Copilot).
4. Open website or images showcasing AI-generated images to introduce students to generative AI art examples.

**Educator Note:** Prior to this classroom activity, students should be familiar with artistic principles relevant to photography and know how to navigate an AI image generation tool (e.g., Google Gemini or Microsoft Copilot for digital media creation).

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## Getting Started (Suggested Time: 5–10 min)

### Educator Actions

1. Share the AI-generated images.
2. Facilitate a class discussion about students' initial reactions to generative AI image creation in art. Questions may include:
  - a. "How do you feel about using AI image generation tools in art?"
  - b. "What challenges might arise from these tools for artists and photographers?"
  - c. "What factors might influence ownership of AI-generated images?"

### Student Actions

1. Review AI-generated art examples and actively participate in the discussion, sharing thoughts about the implications of AI-generated art.

**Educator Note:** Remind students that uploaded images and text prompts may be retained by the company for AI training. Advise them not to input any personal identifiable information into generative AI tools.

# Activity (Suggested Time: 30–40 min)

## Educator Actions

1. Assign AI-generated images to pairs of students.
2. Allow pairs 5 minutes to attempt replicating the image using an AI image generation tool without instruction, highlighting why prompt engineering is a learned skill.
3. Introduce concepts of prompt refinement using principles like specificity and artistic terminology (e.g., depth of field, lighting). Examples of prompts and Adobe Express AI-generated images are provided below.



*Studio shot of futuristic high heels*



*Studio shot of futuristic high heels, warm lighting*



*Studio shot of futuristic high heels, warm red blue gel lighting, shallow depth of field, mechanical materials as props*

*Credit: AI generated images created by Ashley Peterson using Adobe Express*

4. Give pairs another 10 minutes to refine prompts and iterate outputs, encouraging collaborative discussions about strategies that work or fail.
5. Encourage roles between pairs: One student writes down strategies, while the other inputs their prompt into an AI image generation tool. Pairs should switch roles halfway through.
6. Lead a midpoint discussion where pairs share challenges and successes in prompt engineering.

## Student Actions

1. Use an AI image generation tool and the **AI Image Generation Activity** to replicate assigned images with refined prompts, applying feedback and iterative improvements.
2. Collaborate in pairs to document successful strategies and discuss technical challenges.

## Wrap-Up (Suggested Time: 5–10 min)

### Educator Actions

1. Conduct a gallery walk where students observe peer attempts to replicate images.
2. Lead a discussion on societal implications of AI-generated art, asking questions like:
  - a. “What concerns arise in creating and using AI image generation tools?”
  - b. “How do ownership and originality intersect in generative AI tools?”
  - c. “How can you detect if an image is AI generated? Why is this an important skill?”
3. Have students complete the **Reflection Prompts**.
4. If time allows, spark deeper conversations around Adobe Express or Google Gemini’s terms of use and AI-generated image policies.

### Student Actions

1. Write observations on the **Gallery Walk Notes** worksheet during the gallery walk.
2. Participate actively in the class discussion, sharing insights or lingering questions, and complete the **Reflection Prompts**.

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## Extension and Enrichment Activities

Create follow-up opportunities to deepen reflection, build autonomy, or extend classroom discussion.

- **Student Designed Guidelines** – Students work in small groups to create a “Classroom Generative AI Code” that outlines responsible use of generative AI tools based on class discussions and Adobe’s policies.
- **Portfolio Expansion** – Students upload original photos into Adobe Express or other generative AI image tools and refine prompts to create artistically enhanced AI-generated images, presenting their process and result.
- **Career Connections** – Students imagine themselves as part of a creative AI startup, designing the next generation of AI-powered tools while addressing responsible AI technology use challenges such as fairness, transparency, and societal impact. Working in roles like Prompt Engineer, Product Designer, Digital Content Curator, Education Specialist, and Trust and Safety Specialist, students will collaboratively develop a concept for an innovative AI tool and reflect on their responsibilities. Students write a short “Day in the Life” journal entry from the perspective of one of these professionals. Reflection Prompts: What responsibilities might this role involve daily? How does this work help ensure AI systems are used responsibly?

# Resources

Listed below are relevant links and materials to be used with this classroom activity.

- Adobe Express: <https://www.adobe.com/express/create>
- Adobe Firefly: <https://www.adobe.com/products/firefly.html>
  - Examples of Adobe Firefly AI images: <https://www.adobe.com/products/firefly/features/text-to-image.html>
- Google Gemini: <https://gemini.google.com/app>
- Microsoft Copilot: <https://copilot.microsoft.com/>
- PNNL Center for AI: <https://www.pnnl.gov/projects/center-ai>

# Printable Materials

Print the following materials to use with this classroom activity.

- **AI Image Generation Activity**
- **Reflection Prompts**
- **Gallery Walk Notes**

## AI Image Generation Activity

**Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Partner** \_\_\_\_\_

**Image Prompt Details:** *Attach or describe the image prompt you were assigned.*

**Starting Prompt:** *Write down the first prompt you used in your AI image generation tool.*

**Adjustments You Made:** *What changes or refinements did you make to your initial prompt, and why?*

**What Worked Well:** *Describe the aspects of your prompt that produced accurate or useful results.*

**What Didn't Work Well:** *Detail challenges or areas where your prompt failed to meet your expectations.*

## Reflection Prompts

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Societal Implications:** *Choose one societal implication you discussed or thought about during this activity (e.g., authorship, image ownership, impact on traditional artists).*

**Ownership:** *After identifying a societal concern, evaluate your perspective regarding image ownership below. Do you believe the final image belongs to you? Why or why not?*

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## Reflection Prompts

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Societal Implications:** *Choose one societal implication you discussed or thought about during this activity (e.g., authorship, image ownership, impact on traditional artists).*

**Ownership:** *After identifying a societal concern, evaluate your perspective regarding image ownership below. Do you believe the final image belongs to you? Why or why not?*

## Gallery Walk Notes

**Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Instructions:** Choose two peer-created images during the gallery walk and answer the following questions for each.

**Image 1 by Group** \_\_\_\_\_:

*Describe the initial image:*

*What stood out to you about this image?*

*How did their approach differ from yours?*

**Image 2 by Group** \_\_\_\_\_:

*Describe the initial image:*

*What stood out to you about this image?*

*How did their approach differ from yours?*

## Notes

[illegible]





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PNNL-SA-214072