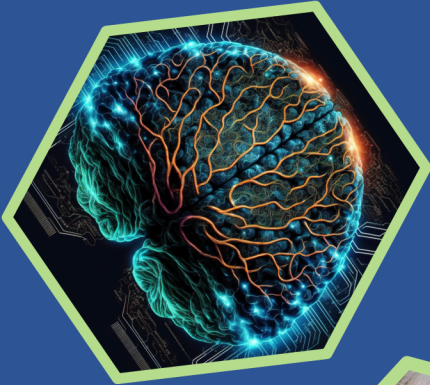




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Technology-Rich Lesson Competition

PURPOSE AND DETAILS

The Technology-Rich Lesson Competition recognizes educators for original, PK-12 (or equivalent) lessons and activities. Submissions must include original lessons or activities that focus on stated goals and objectives. Technology should be integral to the submission and help to improve identified student learning outcomes. Submissions should include the following sections:

- A **concise title** that accurately describes the lesson or activity.
- An **overview paragraph** that indicates the subject, topic, duration, what learners will do, what technology-rich experience(s) will take place, and what assessments will occur.
- A **materials** section that identifies ALL materials needed for implementation.
- A **context and setting section** that describes the intended setting (e.g., urban, rural, public, private), grade-level (or equivalent), classroom characteristics, learner characteristics—including prior content and technical knowledge, instructor characteristics, fit within the larger curriculum, development rationale, and so forth (refer to the first page of the [JTILT lesson plan template](#) for details).
- A **setup section** describing how to set up and organize the learning experience.
- **Goals and learning objectives** and their alignment with professional standards (as applicable).
- The **lesson and instructional strategies** are described in sufficient detail so that others can implement them as-is or adapt them to meet individual needs.
- Copies of resources (e.g., assessments, rubrics, presentations) needed to run the lesson or activity.

SUBMISSION INFORMATION

- **Submissions are due October 1, 2026.**
- Submissions should not exceed six pages, excluding resources (e.g., presentations, work samples, assessments, and rubrics that are included as separate documents).
- Submissions must be original, solely created by the submitter(s), and not published elsewhere (beyond personal websites, blogs, or equivalent personal publication locations).
- Submission resources must be created by the submitter(s), open-access, or include Copyright permissions.
- Submit your lesson and resources on the [JTILT website](#). Login or create a new account. Then select the New Submission button. When the Submit an Article form appears, **select JTILT Competitions** from the Section dropdown. Complete the form and upload your materials.

ELIGIBILITY

- Submitters need not be current members of the [Association of Educational Communications and Technology](#) (AECT) nor the [Teacher Education Division](#) (TED)
- Current AECT TED board members and JTILT editorial board members are ineligible for this competition.

AWARD

- Two winning submissions will each receive \$100 to be split among the authors.
- Winners will be announced in the TED membership meeting during the AECT Annual Convention held November 3-7, 2026 in Chicago, Illinois.
- Winning submissions will be published in JTILT.

Introduction to the Artificial Intelligence Special Issue

Craig E. Shepherd and Frances Alvarado-Albertorio, Editor-in-Chief and Associate Editor

Artificial intelligence, particularly generative artificial intelligence tools (Gen AI) have infiltrated educational discussions over the past few years. These tools are sometimes considered valuable resources to help individuals develop diverse creative endeavors. Tools facilitate illustration, layout and color schemes, voice overs, video production, writing, idea generation, lesson planning, and so forth. However, these tools are simultaneously vilified as biased and inaccurate, resource and energy intensive, plagiarizers, copyright violators, and cheating enablers.

Unlike many educational innovations that promised sweeping change and ultimately under delivered and were forgotten for the next fad, Gen AI seems different. Students and faculty members alike are adopting it rapidly. As Rogers (2003) mentioned, individuals are more likely to adopt innovations when they are compatible with existing norms, can be observed and tried prior to adoption, are easy to use, and provide a relative advantage over the status quo. Gen AI tools seem to fit these requirements well. Through ordinary search queries, users can access and examine AI functionality with minimal to no prior knowledge. Increasingly, major corporations like Google, Microsoft, Adobe embed Gen AI features within flagship software applications to further promote (and market) their use. Although output varies based on prompt quality, tool understanding, tool optimization, and other factors, most tools appear to be good enough to disrupt and alter previous processes (see Christensen, 1997).

As educational institutions consider policies regarding Gen AI tool use, so too do teachers and students. The purpose of this special issue is to examine practices that teachers and teacher educators use to address Gen AI issues in the classroom. Lessons in this issue span the age range of early childhood education to advanced graduate study. The twelve articles in this issue are organized around Gen AI awareness and literacy, ethical considerations with use, and content generation.

ARTICLES IN THIS ISSUE

AI LITERACY AND AWARENESS

The first three articles focus on AI awareness among early childhood and higher education students. The article *AI Education for Young Children (PreK-2): Nurturing Curious and Creative Thinkers* discusses how AI literacy can be introduced and explored by Kindergarten and early elementary school students. Although other articles discuss AI literacy among elementary and secondary students, they focus more fully on content generation. Because of this difference, the next articles *AI Literacy Workshop for Graduate Teaching Assistants* and *Fostering Pre-service Teachers' AI Literacy: Lesson Units to Build Knowledge and Confidence* both center around students in higher education. These articles focus on helping teachers acquaint themselves with AI tools so they can better incorporate them in their classrooms.

ETHICS

The next three articles focus on ethical decisions associated with Gen AI use. All are geared towards higher education students. *Sparkling Students' Eco-Critical Awareness of Generative Artificial Intelligence* encourages undergraduate students to consider and explore the environmental impact of popular AI tools. *Taking Ownership of Gen AI: Connecting AI and Ethics for Undergraduate Students* and *Teaching Students to Identify Ethical Risks and Blind Spots in Academic AI Use* both focus on how students may use AI tools and the ethical decisions they need to make (e.g., copyright and fair use, author voice, bias) when considering their use.

CONTENT GENERATION

The final six articles focus on Gen AI tools to generate content. Three articles focus on secondary education contexts (grades 7-12) while three additional articles focus on preservice teacher education. The first article *Using AI-Generated Multimedia to Teach Leisure Choice Making* leveraged AI generated images to create choice boards for middle school students with autism spectrum disorder.

The next two articles, *Building AI Capacity Through Coding Fundamentals: An AI-Augmented Coding Activity for Teens Using Python, Data Structures, and Verification Practices* and *Exploring Biomes and Ecosystems Using Artificial Intelligence Tools* focus on AI use in secondary schools to critically examine and facilitate Python coding and demonstrate ecosystem knowledge through poster and movie script development.

The final three lessons: AI as a Lesson-Planning Partner in Preservice Teacher's Mixed-Reality Rehearsal, AI – supported Digital Storytelling, and Teaching Prompt Engineering as a Core AI Literacy Skill in Undergraduate Education leverage AI tools to help undergraduate students prepare lesson plans, generate digital stories, and better prompt AI systems.

As you review the lessons in this or any JTILT issue, you may notice that they identify flaws. Authors mention challenges faced, limitations, and lessons learned as they reflect on implementations. These limitations remind us that no lesson is perfect. We encourage you to share your lessons and encourage you to share the flaws you found during implementation. As educators we can learn from others. Your ideas, activities, and challenges will help others in similar settings and situations.

LESSON COMPETITION

This issue also includes information regarding a lesson competition. Submissions are due October 1, 2026 and winners will be announced during the Association for Educational Communications and Technology Annual Convention held in Chicago Illinois November 3-7. Details can be found in the [lesson competition call](#). Please submit your lessons!

GET INVOLVED!

JTILT strives to bring higher education, PK-12 experts and their international equivalents, and related professionals together to consider technology-integrated instruction. The editorial team needs and welcomes your help. Reach out to the editorial team to get involved. Share your ideas and suggestions. Volunteer to review manuscripts. [Information about the peer-review process](#) and [how to volunteer as a reviewer](#) is located on the JTILT website. Additionally, share what you are doing in your learning environment by submitting an original manuscript. [Author guidelines for manuscript submissions](#) are found on the JTILT website.

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- Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Harvard Business Review Press.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

SHARE AND MODIFY THESE LESSONS!

Whether or not you submit manuscripts for the journal or participate in lesson competitions, we hope you use, share, and modify these journal resources. The lessons printed in this journal are provided in sufficient detail that others can implement them without additional details or modify them to meet individual classroom needs. Unless otherwise noted, all JTILT articles, posted presentations, assignments, rubrics, job aids, and so forth are published under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license](#) (pictured below):



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AI Education for Young Children (PreK-2): Nurturing Curious and Creative Thinkers

Sohheon Yang^a and Anne Winiger^b; ^aIndiana University, ^bA Public Elementary School

OVERVIEW

This curriculum introduces PreK-2 students to Artificial Intelligence (AI) to foster curiosity, agency, and ethical awareness. Structured around the AI4K12 framework, the 12 themed lessons cover four phases: 1) digital technology, 2) representation and reasoning, 3) natural interaction and perception, and 4) ethics and societal impact. Individual activities are designed to span 20-30 minutes. Students engage with various web tools, drawing supplies, and screen-free robots. The curriculum cultivates curiosity and ethical awareness of AI. Student questions, discussions, and ideas evidence learning. Students also create their own AI. Assessment occurs through classroom observation, conversation, and student-made artifacts.

Topics: AI, symbolic representation, machine learning, ethics

Time: 20-30 minutes per activity; 10-11 hours total (which can be spread over multiple days).

MATERIALS

- Websites: [Book Creator](#), [Magic School AI](#), [Scroobly*](#), [AutoDraw*](#), [Quick, Draw!*](#), [Animated Drawing*](#), and [Teachable Machine*](#)
- Non-digital tools: [Tale-Bots](#) and drawing supplies
- Video-editing tool: [iMovie](#)
- Storybooks: [Artificial Intelligence for Kids by Dr. Dhoot*](#), and [AI+Me Big idea 1-5 series by ReadyAI*](#) (See the support materials)
- [Presentation slides](#)
- Computer equipment: Classroom touchscreen TV*, webcam*, and microphone
- [Interview Questions](#) and [assessment rubric](#)

* Required tools for this curriculum. Other tools can be swapped out with similar items.

CONTEXT-AT-A-GLANCE

Setting

A Midwestern U.S. public kindergarten.

Modality

Face-to-face.

Class Structure

Team Teaching: A teacher led the co-designed lessons while a researcher assisted. The lessons include circle time, story time, whole-group or small-group discussions, and station or free play.

Organizational Norms

The curriculum meets Indiana academic standards.

Learner Characteristics

26 five-to-six-year-olds of undisclosed ethnicity. Though iPad-proficient and familiar with home devices like Alexa, they had no formal AI experience.

Instructor Characteristics

A teacher with 25 years of experience co-designed the curriculum with an AI education researcher with 4 years of kindergarten teaching experience. Instructors need to possess the technical fluency required for tool management and troubleshooting and/or a growth mindset to explore and master the various tools used in these lessons.

Development Rationale

Despite the benefits of AI curricula for children's literacy and core competencies, a significant gap remains in curriculum design for early childhood education.

Design Framework

Co-design was employed to create a curriculum where a teacher and a researcher collaborate to design and evaluate (Roschelle & Penuel, 2006), while incorporating students' voices into the curriculum.

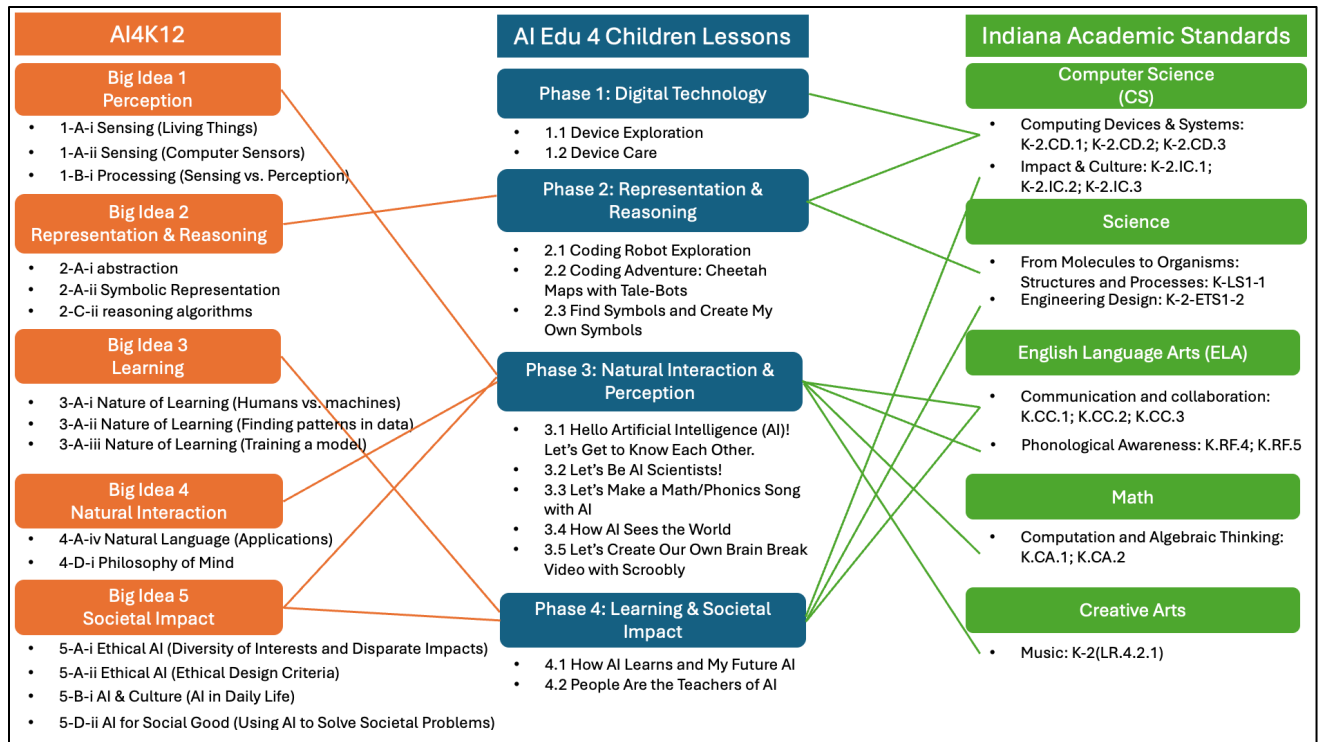


Figure 1. The AI Edu 4 Children Curriculum Framework.

STANDARDS

The AI Edu 4 Children curriculum design was guided by [the Artificial Intelligence for K-12 \(AI4K12\) initiative](#) (2020). This framework outlines the Five Big Ideas: [Perception](#), [Representation and Reasoning](#), [Learning](#), [Natural Interaction](#), and [Societal Impact](#) (AI4K12.org, 2020a, 2020b, 2021, 2022a, 2022b). From these, we extracted the most relevant components for a student-tailored curriculum.

Also, the curriculum aligns with the Indiana Academic Standards for kindergartners (IDOE, 2023), specifically incorporating those identified as core standards by the elementary school. They include [Indiana Early Learning Standards](#), [English Language Arts \(ELA\)](#), [Math](#), [Science](#), [Social Studies](#), and [Computer Science \(CS\)](#). These lessons are designed to be adaptable across various educational contexts.

The curriculum has four phases: 1) digital technology, 2) representation and reasoning, 3) natural interaction and perception, and 4) learning and societal impact/ethics. Figure 1 illustrates how each phase aligns with the AI4K12 Big Ideas and Indiana Academic Standards. Phase 1 is foundational, bridging existing knowledge with AI learning.

CONTEXT AND SETTING

While AI is omnipresent in young children's lives, there is limited discussion regarding early childhood AI education. Several studies show that AI curricula can benefit not only students' AI literacy (Lin & Van Brummelen, 2021; Williams, 2018) but also other competencies such as social-emotional skills, creativity, problem-solving, inquiry, and collaboration (Kewalramani et al., 2021; Su et al., 2023). However, a primary challenge remains the "lack of curriculum design" (Su et al., 2023, p. 10). Therefore, further research and design efforts are essential to create developmentally appropriate learning experiences for young children within AI education.

Co-design was employed to create a curriculum where a teacher and a researcher collaborate to design and evaluate (Roschelle & Penuel, 2006), while incorporating students' voices. Specifically, the teacher's expertise in the existing curriculum and her students' developmental stages was integrated with the researcher's expertise in early childhood AI education to provide a developmentally appropriate learning experience.

The co-design process was initiated by the researcher, who was conducting an independent study on early childhood AI education. The researcher reached out to the teacher they had previously met at a technology-focused practitioner conference to gauge her interest in the co-design project, as shared needs and interests are essential. Although the teacher was new to AI, she was interested in the project and actively engaged with it.

For implementation, the teacher primarily delivered the co-designed lessons, while the researcher assisted and facilitated specific activities. The teacher has 25 years of experience in a U.S. kindergarten, which helped connect ideas into existing curriculum, her regular teaching practice, and her students' developmental stages to improve feasibility of lessons. The researcher has 4 years of kindergarten experience in South Korea and has expertise in technology integration, which helped facilitating tools and ideas exploration. Both valued playfulness in early childhood education

Given this context, it is essential for instructors to have a growth mindset to learn new technologies. While it is ideal for the lead instructor to have an advanced level of technological fluency, they can also be supported by an assistant with stronger technical skills if they work collaboratively.

The learners consisted of 26 kindergartners aged five to six. They were proficient with iPads as the classroom provides 1:1 iPad support. While some students had previously encountered AI in their daily lives through Alexa or AI camera filters, they were not yet aware of the technology behind them. Additionally, the fact that some children used Snapchat or TikTok highlighted the importance of the subsequent lesson on privacy. This curriculum served as learners' first formal introduction to AI education. Their typical day included ELA, math, brain breaks, recess, lunch, stations, and specials such as music or STEM.

The curriculum design was guided by four key principles aimed at fostering students' curiosity and agency through AI education: 1) nurturing curious and creative thinkers, 2) promoting playfulness through hands-on activities, 3) centering children's interests through a contextualized approach, and 4) emphasizing the human role in the AI era. These principles were co-constructed by the teacher and researcher as they articulated their pedagogical beliefs through an iterative co-design process

grounded in cycles of experience and reflection. Furthermore, these principles demonstrated how the AI4K12 Five Big Ideas can be effectively integrated and tailored for early childhood classrooms. Rather than following a prescribed order, we synthesized the AI4K12 Five Big Ideas through an iterative co-design process. This allowed us to tailor the sequence based on our discussions to provide the most effective learning experience for the students.

First, the curriculum aimed to nurture curious and creative thinkers. The initial impetus for designing an AI curriculum for young children stemmed from a fundamental inquiry: What, why, and how of AI education in early childhood? From our first-hand experience in designing and implementing it, we have valued AI education as a way of nurturing curious and creative learners who develop their own learning agency, critical thinking, and creativity in this rapidly changing era, while recognizing that AI education can serve many different goals.

Second, the curriculum emphasized playfulness through hands-on activities. Play is central to early childhood education. Although the lesson plans include some structured activities, we infused playfulness into them by integrating hands-on experiences and connecting with children's prior knowledge and interests. These include drawing, movement, and various hands-on digital technologies.

Third, incorporating children's interests and a contextualized approach served as the primary drivers of the decision-making process. We incorporated children's interests and voices into the lesson plans and considered the existing curriculum of the class by aligning with the Indiana Academic Standards and school culture. This principle serves as a foundation for curriculum design encompassing the Five Big Ideas of the AI4K12 framework. Regardless of which concept a teacher introduces first, it is essential to incorporate children's interests to enhance their learning experiences by establishing meaningful connections to their daily lives.

For example, in the lesson "People Are the Teachers of AI," our students created a "Fish or Not Fish Sorting Game" using the Teachable Machine. This idea came from a student's thought about a future AI that could identify fish, inspired by his own enjoyment fishing. We encourage teachers who read this document to reflect on their students' interests and

voices and to incorporate them into the curriculum to make it contextualized and meaningful.

Lastly, we emphasized the humans' roles in the AI era. Rather than focusing on exact knowledge of AI in early childhood, we valued provoking students' thoughts and attitudes about humans' roles in the AI era: humans as thinkers and teachers in AI training and use, humans' creativity, humans' collaboration with AI, and humans' validation of AI-provided information. These values are closely aligned with the "Learning" and "Societal Impact" dimensions of the AI4K12 framework, as they emphasize human agency and accountability. Ultimately, this ties to realizing our own value as human beings and helping children see themselves as amazing thinkers who are responsible for the creation and use of AI, now and in the future.

This AI Edu 4 Children curriculum aims to foster student agency, "the capacity to set a goal, reflect and act responsibly to effect change" (OECD, 2019, p. 2). This allows students to become active learners in their own learning by acting, shaping, and making decisions responsibly (OECD, 2019). We, as educators, need to see students as active learners, and this can thrive through AI education where students inquire, explore, try out, discuss, critically evaluate, and develop ethical awareness of AI with a curriculum that is relevant to their interests and lives.

LEARNING REPRESENTATION

In the AI Edu 4 Children curriculum, each phase consists of several lessons focusing on similar themes. Each lesson includes various activities such as circle time, whole-group or small-group discussions, story time, and station or free play. These activities do not need to be conducted back-to-back; instead, they can be spread throughout the day or across multiple days depending on students' attention spans and the broader class curriculum.

Also, all storybooks included in all the lessons can be adapted for different developmental levels. For example, a teacher might omit certain sections if the content appears too complex for the kindergarten level. Conversely, teachers can add more depth and interactive elements for older students.

There are four phases in this curriculum: 1) digital technology, 2) representation and reasoning, 3)

natural interaction and perception, 4) learning and societal impact/ethics. The first two phases stemmed from students' interests, which cover general digital technology and a screen-free coding robot. These served as prior experiences for further AI learning. Depending on teachers' pedagogical knowledge and decisions, they could start from Phase 3 and 4 to focus more on AI learning.

PHASE 1: DIGITAL TECHNOLOGY

1. DEVICE EXPLORATION

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

The lesson focuses on exploring digital devices that pique students' interests. Although not directly centered on AI education, it serves as a starting point for sparking curiosity about different types of digital technology and providing a foundational experience that builds a bridge toward AI competency. The learning objectives include:

- Children will be able to explore the device.
- Children will be able to ask questions about the device as a new topic.
- Children will be able to develop an attitude of caring for the device.

Technology Integration: Integrating technology requires different types of digital technology that can be provided in the classroom, such as cameras, microphones, voice recorders, etc.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), vocabulary lesson (30 minutes), and station/free play (20 minutes per group). It uses presentation slides 2-14.

Circle Time: The teacher begins by asking, "Have you ever used a camera before? What can we do with a camera?" This inquiry stemmed from the students' curiosity regarding the researcher's recording equipment. By respecting their interests and treating them as active learners, we provided a learning space where they can freely explore various types of recording devices.

Station/Free Play: Students work in groups to explore different devices (see Figure 2). In this instance, the equipment included recording tools such as cameras, voice recorders, tripods, and camcorders. This can be adapted to include any technology in the classroom.



Figure 2. A group of students exploring a camera and taking pictures.

During this activity, the teacher emphasizes the importance of handling and caring for the devices properly.

Vocabulary Lesson: The teacher presents slides featuring images and names of various technologies, such as cameras, camcorders (video cameras), tripods, microphones, voice recorders, computers, laptops, phones, tablets, televisions, speakers, and robots. As the class reviews the slides, the teacher encourages students to share their prior experiences or ask questions about each type of digital technology.

C. CONSIDERATION

Troubleshooting and Classroom Management: Given that students may become overly excited when working with digital devices, teachers should provide clear guidance on proper device handling and maintenance. By observing student behaviors during initial interactions, teachers can tailor subsequent lessons to address specific device-care protocols more effectively.

Adaptation: This lesson stemmed from the students' interest in recording devices. Depending on the interests of students in different contexts, teachers may initiate the curriculum using other digital technologies that resonate with their students. Alternatively, they may bypass this introductory phase and proceed directly to Phase 2 or 3, which aligns more closely with the AI4K12 framework.

2. DEVICE CARE

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

The lesson focuses on developing and applying students' knowledge and attitudes regarding the care of digital devices. As they begin to use these tools for learning, including AI-related technologies in the near future, it is essential that they understand how to handle them responsibly. The learning objectives include:

- Children will be able to develop a caring attitude toward the device.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes) and whole-group discussion (25 minutes). It uses presentation slides 15-23.

Circle Time: The teacher asks, "What are some things we use every day that we need to take care of?" Examples might include toys, books, and pets. This question connects to digital technology, allowing teacher to follow-up with "How do we take care of our devices?"

Whole-Group Discussion: A class goes over slides featuring how to take care of devices. The behaviors include:

- Clean Hands, Happy Devices: "Why should we have clean hands before touching a tablet or laptop?" (Keeps screens and buttons from getting sticky!)
- Gentle Hands, No Ouchies: "What happens if we drop a tablet or press too hard on a screen?" (Cracks, breaks, or stops working!)
- Charging is Important: "What happens if we forget to charge a device?" (It won't work when we need it!)
- Safe Places Only: "Where should we put a tablet when we are not using it?" (On a table, not the floor or near water!)
- Ask Before Downloading or Clicking: "Should we press buttons or download things without asking a teacher or parent?" (No! Some things might not be safe.)

C. CONSIDERATION

Adaptation: The teacher can add a drawing or coloring activity to provoke students' interest in different types of technology (see Figure 3). How to take care of devices can be emphasized throughout the course as it's a fundamental attitude that students need to develop. In a later phase, this discussion will be expanded regarding privacy and ethical issues to protect myself and others while using devices.



Figure 3. Students coloring different types of technology.

PHASE 2: REPRESENTATION & REASONING

1. CODING ROBOT EXPLORATION

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Building on the previous lessons of device exploration, the teacher introduces a screen-free coding robot. The lesson focuses on exploring the coding robot and gaining familiarity with it. The experience serves as a foundational entry point for symbolic representation as students explore symbols within the coding robot like different directional arrows. The learning objectives include:

- Children will be able to explore a tangible coding robot (non-AI) and get familiar with it.
- Children will be able to recognize and use symbols of the Tale-Bot (e.g., colors, arrows, loop, etc.)
- Children will be able to develop an attitude toward caring for the tangible coding robot.

The AI4K12 framework (AI4K12.org, 2021) includes:

- #2 Representation - Symbolic representation - 2-A-ii
 - Learning objective (LO): Give examples of symbols you encounter in daily life.
 - Enduring understanding (EU): Concepts can be represented using symbols in place of words.

Technology Integration: Integrating technology requires enough Tale-Bots to accommodate your student groups, plus drawing supplies and large paper for creating maps.

B. LESSON FLOW

The lesson is composed of station/free play (25 minutes).

Station/Free Play: Students explore a Tale-Bot (see Figure 4), a screen-free coding robot, as individuals or in groups.



Figure 4. A Tale-Bot.

C. CONSIDERATION

Troubleshooting and Classroom Management: Given that students may become highly animated when interacting with a new robot, device-care protocols should be integrated throughout all lessons involving hands-on technology. Specifically, when using the Tale-Bot's voice recording function, students may enjoy making loud or unconventional sounds. If this becomes a distraction, the teacher should clarify the purpose of the recording and guide students on how to produce high-quality audio that aligns with the lesson's goals.

Adaptation: Based on observation, the teacher can expand this exploration so students can be familiar and confident using the robots before moving on to the next lesson. The teacher can have students utilize existing maps or create maps to navigate with their Tale-Bots.

2. CODING ADVENTURE: CHEETAH MAPS WITH TALE-BOTS

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Now that students have developed a foundational understanding of the Tale-Bot's functions, this lesson transitions into a deeper exploration of symbolic representation alongside creative expression. The lesson focuses on applying symbolic representation by drawing a map that represents only important pieces of information. The map-creation themes can be adapted to suit the specific interests and contexts of different classes. Also, this lesson fosters computational thinking by utilizing Tale-Bots to navigate the map. The learning objectives include:

- Children will be able to draw and construct an animal-themed map based on what they learned about animals (e.g., appearance, habitat, characteristics, diet).
- Children will be able to recognize and use Tale-Bot symbols (e.g., colors, arrows, loop).
- Children will be able to develop a sequence to go through the animal-themed map depending on instruction.

The AI4K12 framework (AI4K12.org, 2021) includes:

- #2 Representation - Abstraction - 2-A-i
 - LO: Construct a map of a home, school, or neighborhood.
 - EU: The map is not the territory. A map is a representation of a territory.
- #2 Representation - Symbolic representation - 2-A-ii
 - LO: Give examples of symbols you encounter in daily life.
 - EU: Concepts can be represented using symbols in place of words.
- #2 Reasoning - Reasoning algorithms - 2-C-ii
 - LO: Model the use of a classification or search algorithm to solve a problem.
 - EU: Reasoning algorithms are ways to solve reasoning problems.

Technology Integration: Integrating technology requires enough Tale-Bots to accommodate your student groups, plus drawing supplies and large paper for creating maps.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), whole-group discussion (25 minutes), and station/free play (20 minutes per a group). It uses presentation slides 24-35.

Circle Time: The teacher opens with guiding questions: “What is a map? Have you seen one before? Why do people use them? If you could make a map, what kind would you create?” This discussion bridges students’ prior knowledge with the upcoming activities.

Whole-Group Discussion: The teacher presents slides introducing maps, explaining that “a map is a picture that shows where things are.” The activity moves from a broad to narrow focus: starting with a world map, then moving to a map of the United States, a state map, and finally a city or town map. Since the class was planning a field trip to the zoo, a zoo map was included at the end of this activity.

As the class explores these maps, the teacher asks students what they see to help them connect their observations to symbols. Afterward, the class creates their own map. For example, following a story about cheetahs, the students designed a cheetah-themed map, identifying important features like tear marks, tails, and spots to represent the animal.

Station/Free Play: Students explore their maps with Tale-Bots, either individually or in groups (see Figure 5). They program Tale-Bots to navigate from one area to another. This activity can be unstructured for free exploration or more guided, depending on the teacher’s pedagogical intentions and the students’ proficiency with the technology.



Figure 5. Students navigating their map with Tale-Bots.

C. CONSIDERATION

Adaptation: It is important to bring maps that are relevant to students' lives. For example, we started from a world map and moved to their town and the zoo they planned to visit. Although this activity is not directly related to AI itself, it is a foundational activity that focuses on symbolic representation.

During the whole-group discussion, it is important to observe students' understanding and reactions so the teacher can connect them to sequenced activities. For example, when we observed that students found symbols (e.g., a shopping cart as a symbol of a market; see Figure 6) in a town map, we connected this observation to the next activity focusing on understanding and creating symbols.

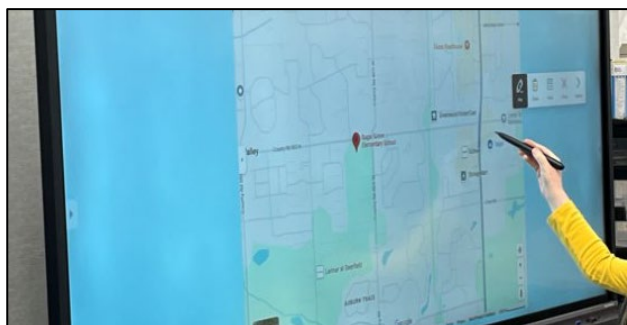


Figure 6. Student pointing to a symbol she found on the map.

Also, for map-making, the themes can be dependent on each class's current curriculum. For example, we talked about animals before going to the zoo, so the theme of the maps was about cheetahs.

3. FIND SYMBOLS AND CREATE MY OWN SYMBOL

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

The lesson now establishes a closer connection to the students' daily lives by encouraging them to observe their surroundings and create their own meaningful artifacts. The lesson more closely relates to students' lives by encouraging them to look around the world and create their own artifact. The lesson focuses on symbolic representation by finding examples of symbols in students' lives and creating their own symbol with abstraction skills, which is a

brief connection with the symbolic representation of AI. The learning objectives include:

- Children will be able to identify symbols and their meanings in their daily lives.
- Children will be able to create their own symbols representing their own core characteristics.

The AI4K12 framework (AI4K12.org, 2021) includes:

- #2 Representation - Symbolic representation - 2-A-ii
 - LO: Give examples of symbols you encounter in daily life.
 - EU: Concepts can be represented using symbols in place of words.

Technology Integration: Drawing supplies for creating symbols are needed. To create a digital class book at the end, [Book Creator](#) can be utilized.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), whole-group discussion (25 minutes), and station/free play (30 minutes). It uses presentation slides 36-43.

Circle time: The teacher begins by asking questions about the students' experience with Tale-Bots, saying, "What did you like about the Tale-Bots, and what was difficult when you played with them?" Through this conversation, the teacher can connect student experiences with symbols. For example, some students may still be curious about what each button means or struggle to have Tale-Bots navigate maps as they intended. This difficulty may come from a lack of understanding of each symbol's meaning, so the teacher can use the Tale-Bot experience to cover the topic of symbols (see Figure 7).

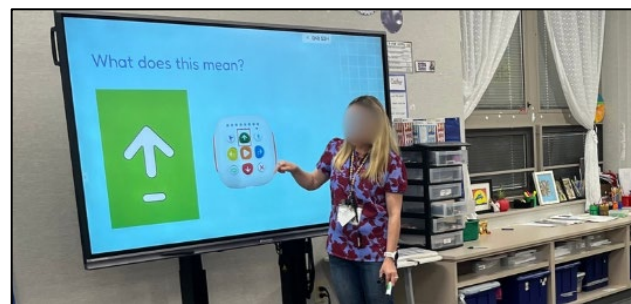


Figure 7. Teacher and students discussing Tale-Bot symbols.

Whole-Group Discussion: Reviewing the map activity from last session, the class goes over different symbols in their daily lives. The teacher can create slides with different symbols found in their community, such as restrooms, school symbols, stop signs, and markets (see Figure 8). The class is also asked to find symbols in the classroom. For example, one student brought up the numbering system in the class, matching each number with a certain student. Another student brought up a code on a smart TV that represented the teacher’s sign-in ID.

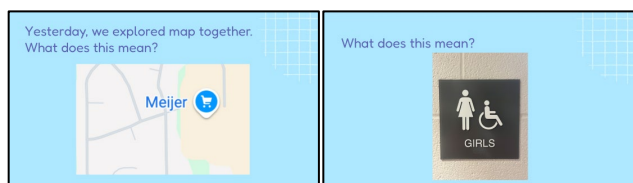


Figure 8. Slides about symbols around us.

Station/Free play: Students think about a core characteristic to represent themselves. Then, students freely draw their own symbols to represent that characteristic and describe the meanings. The teacher can turn these into a class book and read it together with the students.

For example, we used Book Creator for the class book (see Figure 9), printed it out, and read it together. The students engaged in figuring out which symbols belonged to whom by guessing the reasons. This serves as a bridge to how AI uses symbols to understand the world and perform tasks.



Figure 9. Classroom book with Book Creator: Isabella’s symbol (pseudonym).

C. CONSIDERATION

Adaptation: It is important to encourage students’ symbolic representations by connecting them to their lives, such as symbols in the classroom, school, and community. Although this activity is not directly

related to AI itself, the teacher can make a connection between symbolic representation and AI: Computers and robots don’t have hearts or minds like we do. They do not understand things on their own. Instead, they follow special signals called symbols. A symbol is like a secret code that tells the computer exactly what to do based on our rules.

PHASE 3: NATURAL INTERACTION & PERCEPTION

1. HELLO, ARTIFICIAL INTELLIGENCE (AI)! LET’S GET TO KNOW EACH OTHER

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Following the students’ exploration of digital devices and Tale-Bots, teachers can extend their curiosity to the AI technologies already present in their environments. Their existing familiarity with technology provides a strong foundation for this expansion. This lesson introduces AI, tailored to the children’s level. The learning objectives include:

- Children will be able to recognize that AI is a kind of technology.
- Children will be able to describe what AI means.
- Children will develop their curiosity about AI.

The AI4K12 framework (AI4K12.org, 2022a, 2022b) includes:

- #4 Natural Interaction - Natural Language (Applications) - 4-A-iv
 - LO: Demonstrate the kinds of tasks an intelligent assistant can and cannot perform.
 - EU: Intelligent assistants (e.g., Siri, Alexa) are computers designed to respond to a limited set of requests. They cannot engage in a conversation like a human.
- #5 Societal Impact - AI & Culture (AI in Daily Life) - 5-B-i
 - LO: Identify devices in daily life that use AI technologies.
 - EU: AI technologies are part of any device that includes speech recognition or computer vision, such as smartphones, intelligent home assistants, and modern automobiles.

Technology Integration: The discussion requires real objects representing something natural and something artificial (e.g., a real flower and an artificial flower; see Figure 10) to help students understand what “artificial” means. For story time following the discussion, the teacher needs to prepare the picture book [Artificial Intelligence for Kids by Dr. Dhoot](#), either as a paper copy or as slides. The order of these activities can be switched.



Figure 10. Natural flowers and artificial flowers in the classroom.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), whole-group discussion (25 minutes), and story time (20 minutes). It uses presentation slides 44-54.

Circle time: The lesson starts with a circle time question, “Let’s think about how amazing our brains are! What do you love to do the most? What cool things can your brain help you do? What are you really good at?” The teacher then listens carefully to each student’s thoughts, encouraging them to reflect on their own abilities and skills as humans. This discussion serves as a starting point for identifying similarities and differences between humans and AI, ultimately helping students develop an understanding of how valuable they are as human beings.

Whole-Group Discussion: Next, the class moves to a discussion to introduce AI by connecting it to students’ interests and lives. They discuss what artificial intelligence means, beginning with a vocabulary lesson that explains “artificial” and “intelligence” separately. Comparing natural and artificial objects was an effective way to deepen students’ understanding of the concept of “artificial.” Bringing artificial items such as plastic flowers or

fruits that students can easily compare with natural ones can provide meaningful learning opportunities (see Figure 11).



Figure 11. Teacher comparing real flowers and artificial flowers.

Story time: The teacher reads the picture book [Artificial Intelligence for Kids \(Tinker Toddlers\) by Dr. Dhoot](#) to the students and interacts with them during the reading. Leverage students’ ideas and curiosity while reading the book. For example, a child asked, “What if people make a cow?” when the picture book compared something natural (e.g., a cow) with something artificial made by people (e.g., a car). The teacher connected this question to a discussion about what makes a cow artificially intelligent. Next time, we showed a real-life video of an AI robot cow to illustrate that this is happening in the world.

C. CONSIDERATION

Adaptation: This activity begins with student specific interests and/or prior experiences. In this case, it was connected to manually programming Tale-Bots and then exploring how they differ from AI. The discussion also included examples of AI in everyday life, such as Alexa, Snapchat’s AI filters, and social robots that students had mentioned previously. In other classes, teachers can start from different contexts; the key is to begin with your students’ concrete interests and/or experiences.

Assessment: Following the discussion, the teacher can utilize students’ artifacts to assess their understanding of AI. For example, students distinguished between what is artificial and what is natural and drew examples of each (see Figure 12).

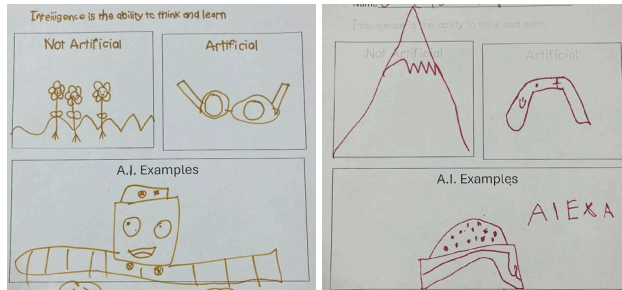


Figure 12. Students’ artifacts.

2. LET’S BE AI SCIENTISTS!

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Drawing from observations of students’ diverse inquiries regarding AI, the lesson focuses on exploring students’ own questions, seeking relevant information, and engaging in collaborative discussions to address questions. The learning objectives include:

- Children will be able to compare and contrast what humans and AI can do.
- Children will discuss how humans and AI are similar and how they are different.
- Children will develop their curiosity about AI.

The AI4K12 framework (AI4K12.org, 2022a) includes:

- #4 Natural Interaction - Natural Language (Applications) - 4-A-iv
 - LO: Demonstrate the kinds of tasks an intelligent assistant can and cannot perform.
 - EU: Intelligent assistants (e.g., Siri, Alexa) are computers designed to respond to a limited set of requests. They cannot engage in a conversation like a human.
- #4 Natural Interaction - Philosophy of Mind - 4-D-i
 - LO: Demonstrate some ways that Intelligent agents don't understand things the way people do.

- EU: Artificial Intelligence devices are not people, they are computer programs designed by people.

Technology Integration: The small-group discussion requires the book [Big Idea 4 – Human-AI Interaction: How We Work with AI/ by Ready AI](#), as well as large sheets of paper, pencils, pens, and erasers for creating a comparison chart of AI and humans.

B. LESSON FLOW

The lesson is composed of small-group discussion (15 minutes), story time (15 minutes), and comparison drawing chart (30 minutes). It uses presentation slides 55-56.

Small-Group Discussion: The teacher briefly discusses students’ previous questions and what scientists do. For example, students’ questions might include, “What is AI?” or “How can it move?” Other questions could be, “How can we make Alexa?” or “Can I talk with AI?” Then, the teacher connects students’ questions to a discussion about what humans and AI can and cannot do. The teacher could say, “Last time, a few of you said, ‘Can AI have a conversation? I want AI to learn how to talk like we do!’”; “Let’s think about what you can do first. What do you do well? What do you like to do?”; “Do you think AI can do this too? Why or why not? How could it do this?”

Story Time: Following the discussion, the teacher reads the book [Big Idea 4 – Human-AI Interaction: How We Work with AI/ by Ready AI](#) to the students to facilitate and expand the small-group discussion. Through the book, students can source relevant information to address their questions regarding the capabilities and limitations of AI.

Comparison Drawing Chart: Students draw what humans can do and what AI can do. The activity can be extended to include other factors, such as what humans find difficult to do and what AI cannot do. Considering students’ developmental levels, drawings with letters are encouraged if they can write.

C. CONSIDERATION

Troubleshooting and Classroom Management: Since this is a student-led research process facilitated by the teacher, it requires sufficient time for exploration. This process can be extended over multiple days and

enhanced through home-to-school connections, such as asking students to bring a relevant book or to research information with their caregivers.

Adaptation: Based on students' own questions, their interactions, and the information they find with the teacher, the outputs can be varied and contextual. Creating a comparison drawing chart can also be done using digital media such as Book Creator, Google Slides, Padlet, or other collaborative workspaces if students are comfortable using them.

3. LET'S MAKE A SONG WITH AI

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

To deepen the exploration of AI's potential, this lesson introduces generative AI through a song-making activity. This approach was intentionally aligned with the teacher's instructional strategies of using songs in Math and ELA blocks, ensuring the AI experience remained pedagogically relevant. The lesson focuses on human-AI collaboration in creating a song related to what students have learned. The learning objectives include:

- Children will be able to discover what AI can do in song making.
- Children will be able to identify the roles of AI and humans in song making.
- Children will be able to evaluate the AI-generated song.
- Children will collaborate with AI to create a song.

The AI4K12 framework (AI4K12.org, 2022a) includes:

- #4 Natural Interaction - Natural Language (Applications) - 4-A-iv
 - LO: Demonstrate the kinds of tasks an intelligent assistant can and cannot perform.
 - EU: Intelligent assistants (e.g., Siri, Alexa) are computers designed to respond to a limited set of requests. They cannot engage in a conversation like a human.

Technology Integration: The whole-group discussion requires a song generator in [Magic School AI](#) as a generative AI (GAI) tool. It was chosen over other commercial GAIs, such as ChatGPT or Gemini, due to age restrictions and privacy concerns. The teacher acts as a mediator, facilitating the process and

providing input to the GAI based on students' text-based interactions.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes) and whole-group discussion (30 minutes). It uses presentation slide 57.

Circle time: The lesson starts with the question, "What's your favorite song?" to spark students' interest in songs. The teacher can use this information to select a melody for the song-generation activity. They also discuss the similarities and differences between songs and spoken language, and how we create songs, as a starting point for this lesson.

Whole-Group Discussion (Song Generation): The teacher reminds students about the meaning of AI and talks about their experience of creating or/and singing a song. Then, they connect the discussion with AI (e.g., Say: AI can help make songs by using examples it has seen. It doesn't feel or create like people do, but it can copy patterns it's learned.)

Now, the teacher talks about humans' role in song making and gather students' thoughts about what words or sounds they want to include in a song. For example, in our case, students were learning about subtraction in a math block, and they brought up concepts that they've learned about subtraction such as "minus," "take away," "equals." Then the teacher input the words into Magic School AI and selected "Row, Row, Row Your Boat" for melody.

Once the class has Magic School AI create a song, they can sing along. In this way, they experience collaboration with AI through learning and play. An important teachable moment is validating the generated content to see if it makes sense to humans. When AI creates something incorrect, use this time to validate the content and discuss with students. The teacher can facilitate this process by emphasizing that AI has limitations, so people always need to double-check the information provided. (e.g., What's your important job? Think first! Share your own ideas. Then check! Make sure the song makes sense and sounds right. Enjoy singing!)

C. CONSIDERATION

Troubleshooting and Classroom Management: It can be challenging to strictly differentiate the roles of the teacher, the students, and the AI, but if possible, discuss the similarities and differences in the roles each has played. For example:

- Students’ Job: Think, explore, and ask questions.
- Teacher’s Job: Help and guide children by asking questions and providing support.
- AI’s Job: Generate a song by learning from many examples.

Adaptation: This lesson can be adapted to different contexts when you want to use a song to support students’ learning on various topics, such as CVC words, subtraction, decomposition, butterflies, and more. It also requires enough time to discuss the roles of humans and AI. The discussion can take place in small groups for more in-depth exploration.

Several alternative platforms are available as additional options for implementation. School AI has a voice option, so young children can interact with it verbally under the teacher’s guidance. Suno AI generates its own melody with different moods based on a prompt, making it another option for use.

4. HOW AI SEES THE WORLD

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Building on their initial experiences with AI, this lesson focuses on perceptions and senses by identifying similarities and differences between humans and AI in terms of how they perceive the world through their senses. The learning objectives include:

- Children will be able to identify human senses and sensory organs.
- Children will be able to locate and identify sensors (camera, microphone) on computers, phones, robots, and other devices.
- Children will develop their curiosity about AI.

The AI4K12 framework (AI4K12.org, 2020a) includes:

- #1 Perception - Sensing (Living Things) - 1-A-i
 - LO: Identify human senses and sensory organs.

- EU: People experience the world through sight, hearing, touch, taste, and smell.
- #1 Perception - Sensing (Computer Sensors) - 1-A-ii
 - LO: Locate and identify sensors (camera, microphone) on computers, phones, robots, and other devices.
 - EU: Computers "see" through video cameras and "hear" through microphones.
- #1 Perception - Processing (Sensing vs. Perception) - 1-B-i
 - LO: Give examples of intelligent vs. nonintelligent machines and discuss what makes a machine intelligent.
 - EU: Many machines use sensors, but not all use them intelligently. Non-intelligent machines are limited to simple sensing. Intelligent machines demonstrate perception.

Technology Integration: Story time requires the book [Big Idea 1 – Perception: How AI Sees the World by ReadyAI](#). The whole-group discussion requires [Scroobly](#), an AI-powered animation platform, and a webcam connected to a shared touchscreen.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), story time (20 minutes), and whole-group discussion (15 minutes). It uses presentation slides 58-60.

Circle Time: The teacher facilitates circle time with a guided question: “What do you do with your five senses—eyes, nose, ears, tongue, and skin?” This interaction is designed to pique students’ interest and increase their awareness of their five senses and their functions. This serves as a foundation to later connect human biology with AI technology: “Can you guess how AI sees the world? Today, we will learn more about how AI ‘sees’ the world, just as we do through our five senses.”

Story Time: The teacher reads the book [Big Idea 1 – Perception: How AI Sees the World](#) by ReadyAI to facilitate a discussion about the similarities and differences between human senses and AI sensing: Explore how our senses work and how computer sensors correspond to them (e.g., seeing – eyes and a camera; hearing – ears and a microphone; speaking – a mouth and a speaker). During this interaction, students can explore the classroom to identify physical sensors, such as cameras or microphones, where available.

Whole-Group Discussion: The teacher briefly introduces Scroobly and how it uses a camera sensor. They could say, "It uses a camera sensor to watch how we move, and it can help our character copy us. You can choose a character or even make your own! Today, we will play with Scroobly to create our own brain break video." Students will briefly view the interface as a whole group and then engage in more in-depth interaction in small groups later.

C. CONSIDERATION

Adaptation: This lesson could begin by exploring the students' own bodies and the five senses, aligning with the standard curriculum often introduced at the start of a kindergarten semester. This self-knowledge then serves as a bridge to understanding AI through an exploration of their similarities and differences.

5. LET'S CREATE OUR OWN BRAIN BREAK VIDEO WITH SCROOBLY

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

Building on their initial exploration of sensors and Scroobly, this lesson incorporates an application and creation phase. The lesson focuses on creating something relevant to students, allowing them to exercise their creative muscles by collaborating with AI. The learning objectives include:

- Children will be able to utilize a camera sensor in AI-powered technology to express motions appropriately.
- Children will be able to create a video by expressing motions and singing a song, shifting their role from a consumer to a creator.
- Children will be able to collaborate with AI to create a video.

The AI4K12 framework (AI4K12.org, 2020a) includes:

- #1 Perception - Sensing (Living Things) - 1-A-i
 - LO: Identify human senses and sensory organs.
 - EU: People experience the world through sight, hearing, touch, taste, and smell.
- #1 Perception - Sensing (Computer Sensors) - 1-A-ii

- LO: Locate and identify sensors (camera, microphone) on computers, phones, robots, and other devices.
- EU: Computers "see" through video cameras and "hear" through microphones.

Technology Integration: [Scroobly](#) is a free, AI-powered website where students create animations using their body movements. In the classroom, it can be used with a webcam and projected onto a smart TV or accessed via devices like iPads and laptops.

B. LESSON FLOW

The lesson is composed of whole/small-group discussion (20 minutes) and station/free play (15 minutes per group). It uses presentation slide 61.

This lesson builds on students' interest in brain breaks, such as singing along to songs and moving together. Through this activity, students naturally observe how AI perceives the world through a camera sensor and learn how to collaborate with it.

Whole/Small-Group Discussion: The class creates a song. It can be written from scratch or based on an existing melody. In our case, we used the melody from "Go Bananas," as it is a student favorite. We adapted the lyrics to a car racing theme, based on a major racing event in the state.

At this stage, the teacher records the students' singing. We recommend using a tablet to capture both audio (M4A) and video (MOV) files; this redundancy ensures maximum compatibility during editing and provides backup in case of file corruption.

Station/Free Play: Once students become familiar with their created song, each group creates a specific movement and records it using Scroobly based on their assigned lyric. For example, our groups (1–6) each performed a different action: "Start your engines," "Step on the gas," "Zoom down the track," "Turn the corner," "Hit the brakes," "Wave the flag." (see Figure 13). With the melody from "Go Bananas," the song looks like this: "First you start, start, start your engine, yeah, you start, start, start your engine. Then you step, step, step on the gas, yeah, you step, step, step on the gas."

The teacher records students' movements using Scroobly, which exports files in GIF format. If your video editing platform does not support GIFs, screen-record the playback of each student's video; this

ensures the file is saved in a format compatible with most editing software. In our case, we used [iMovie](#) on a Mac. The teacher's final tasks involve: 1) importing all separate video clips, 2) compiling them into a sequence, 3) incorporating the song file, and 4) adding subtitles or other artifacts, such as students' drawings (optional). After the editing is finished (at least a day later), the entire class views their custom-made brain break video.

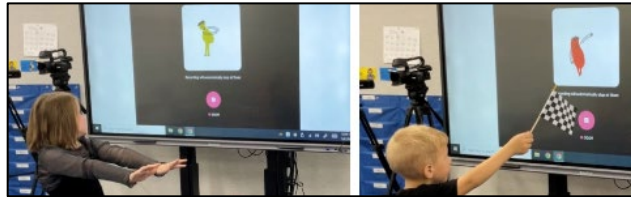


Figure 13. Students making movements using Scroobly.

C. CONSIDERATION

Troubleshooting and Classroom Management: To optimize Scroobly's motion-capture capability, ensure only one person is in the scene at a time and use a clear background. If multiple people are present, the system may struggle to track a single subject, causing the capture to jump between individuals and hindering the quality of the recording. Additionally, because Scroobly may occasionally experience latency in syncing movements, the teacher can guide students to move more slowly than usual to ensure the AI tracks their motions accurately.

Adaptation: The main theme of the brain break video was inspired by students' interest in the "Kindy 500," a school-wide family activity. The theme can vary depending on the context, and students can contribute ideas for movements to express themselves and create the video.

PHASE 4: LEARNING & SOCIETAL IMPACT/ETHICS

1. HOW AI LEARNS AND MY FUTURE AI

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

While Phases 1 through 3 focused on providing students with hands-on experience using various

technologies and AI for creative expression, Phase 4 delves deeper into the mechanisms AI learning. This phase also examines the societal impact of AI on students' lives and surroundings. The lesson introduces AI supervised learning in a child-friendly way and emphasizes that the human role is essential to the process. The learning objectives include:

- Children will be able to recognize that AI learns by looking at lots of examples.
- Children will be able to recognize that people give examples to AI.
- Children will be able to recognize that it is important for people to give many different kinds of examples (diverse examples).
- Children will be able to describe how people and computers learn differently.

The AI4K12 framework (AI4K12.org, 2020b, 2022b) includes:

- #3 Learning - Nature of Learning (Humans vs. machines) - 3-A-i
 - LO: Describe and provide examples of how people learn and how computers learn.
 - EU: Computers learn differently than people.
- #3 Learning - Nature of Learning (Finding patterns in data) - 3-A-ii
 - LO: Identify patterns in labeled data and determine the features that predict labels.
 - EU: Classes can be defined in terms of feature values. The relevant features can be inferred by examining labeled examples.
- #3 Learning - Nature of Learning (Training a model) - 3-A-iii
 - LO: Demonstrate how to train a computer to recognize something.
 - EU: Computers can learn from examples.
- #5 Societal Impact - AI for Social Good (Using AI to Solve Societal Problems) - 5-D-ii
 - LO: Describe how AI can be used to solve a societal problem.
 - EU: AI can be used to create a classifier that solves a problem important to society.

Technology Integration: For story time, the lesson utilizes [Big Idea 3 – Machine Learning: How AI Learns by ReadyAI](#). Using a large smart TV for whole-group discussion, the class uses [AutoDraw](#) and [Quick, Draw!](#) to explore how AI learns from vast image datasets and predicts outcomes through pattern recognition. Finally, the teacher utilizes [Animated Drawings](#) to bring students' drawings of future AI to life in a digital space.

B. LESSON FLOW

The lesson is composed of circle time (15 minutes), story time (20 minutes), whole-group discussion (20 minutes), and station/free play (20 minutes). It uses presentation slides 62-69.

Circle Time: The teacher starts with a question, “How do you learn to do something new, like tying your shoes or drawing a cat? How do you think a computer learns?” This conversation encourages students to reflect on human learning and provides a bridge to discuss AI learning.

Story Time: The teacher goes over a storybook, [Big Idea 3 – Machine Learning: How AI Learns by ReadyAI](#). Students see how AI learns by using many images of Cream (a dog).

Whole-Group Discussion: The teacher talks about pattern recognition. For the [AutoDraw](#) activity, students come up front and draw something they want while others try to guess it. They naturally compare human guesses and AI guesses. If AI guesses wrong, there is a teachable moment and discussion about why AI guessed incorrectly. The teacher could say, “Let’s guess how and why the AI made a prediction based on what I was drawing. We’ll talk about how AI can be fun, but sometimes it gets things wrong or doesn’t understand what we mean. It’s important to always check what AI made!” (see Figure 14).

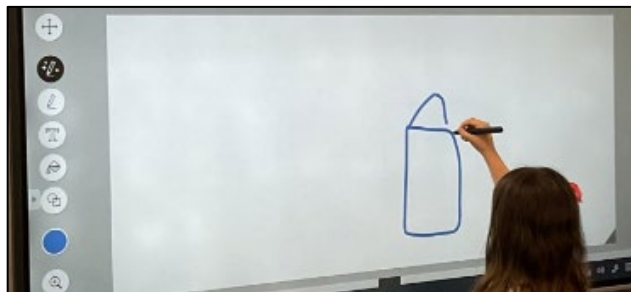


Figure 14. A student drawing a house using AutoDraw.

Then, as a class move on to the [Quick, Draw!](#) Activity. Students will be able to visually see that a bunch of images are needed for AI to learn, such as apples, angels, clocks, and more (see Figure 15). The teacher could say, “We’ll look at how many pictures the AI needs to learn from. That helps it get better at guessing! We’ll also talk about how it’s important to give the AI enough, good-quality examples (e.g., lots of different kinds of pictures).”



Figure 15. A Student Picking Up a Sample Drawing to See Other Examples on Quick, Draw!

At the end of the activity, the teacher asks the students for their ideas about future AI. To allow them to share and visualize their thoughts, they can draw their own designs during free play or station time. The teacher prompts them: “What differences do you want our AI machine to be able to recognize? What will your future AI look like? We will draw our designs today and create a real AI machine tomorrow!”

Station/Free Play: Students draw their own future/helpful AI. (see Figure 16). If the teacher focuses on the societal impact of their AI, this connects to the AI4K12 framework: “Describe how AI can be used to solve a societal problem.”

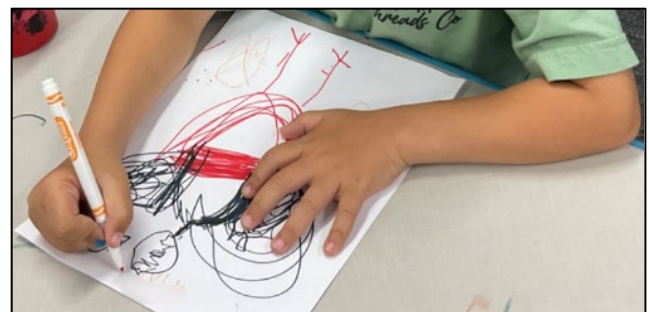


Figure 16. A student drawing an AI chicken robot that can classify good eggs and bad eggs.

C. CONSIDERATION

Classroom Management and Assessment: While designing their Future AI, some students may create drawings unrelated to AI’s functional features. In such cases, the teacher should scaffold their learning by reinforcing concepts like classification or perception. Observing how students incorporate these features serves as an authentic assessment of

their understanding of AI's mechanisms and its impact on human life.

Adaptation: Drawing my own future AI activity can be implemented at the end of the entire series of activities to help students reflect on what they have explored and learned. Their drawings can serve as an assessment to gauge their understanding of AI. Also, their drawings can be animated and brought to life using [Animated Drawings](#). For example, in our case, there was a dance party day where teachers created videos of their future AI moving and dancing using Animated Drawings (see Figure 17).

The teacher saves each video by selecting specific movements from the Animated Drawings library and exporting them as MP4 files via the share function. Using video editing software (e.g., iMovie), the teacher follows a process similar to the one used in the Scroobly activity. The final post-production tasks involve: 1) importing the separate video clips, 2) compiling them into a sequence, 3) incorporating the audio file (optional), and 4) adding subtitles (optional).

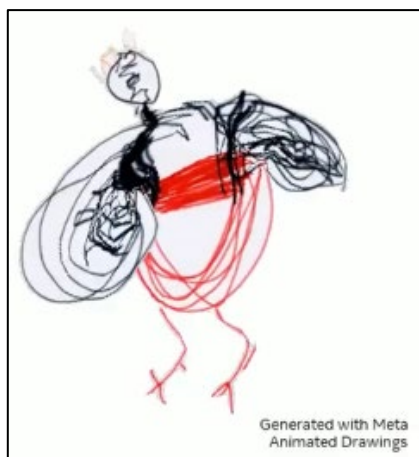


Figure 17. Animated drawing of an AI chicken robot dancing.

2. PEOPLE ARE THE TEACHERS OF AI

A. LEARNING OBJECTIVES & TECHNOLOGY INTEGRATION

As a final project, students develop a functional machine learning model through a child-friendly approach, collaborating as a whole class or in small groups. The lesson focuses on cultivating ethical

awareness of AI by exploring its societal impact and the role humans play in its development and use. The learning objectives include:

- Children will be able to recognize that AI learns from data and patterns but does not know everything.
- Children will be able to recognize that AI has strengths and limitations.
- Children will be able to identify the human role in teaching AI through the process of data training using Teachable Machine.
- Children will be able to discuss the societal impact of AI on various aspects of human life.
- Children will be able to recognize the importance of protecting their personal information.

The AI4K12 framework (AI4K12.org, 2020b, 2022b) includes:

- #3 Learning - Nature of Learning (Training a model) - 3-A-iii
 - LO: Demonstrate how to train a computer to recognize something.
 - EU: Computers can learn from examples.
- #5 Societal Impact - Ethical AI (Diversity of Interests and Disparate Impacts) - 5-A-i
 - LO: Evaluate the ways a decision impacts people differently.
 - EU: Computers can sometimes make a decision that works for most people but harms or disadvantages other people.
- #5 Societal Impact - Ethical AI (Ethical Design Criteria) - 5-A-ii
 - LO: Discuss the characteristics of systems that are fair and unfair and the impact on people when a system is not fair.
 - EU: AI systems should be designed to benefit people. Creators of these systems should make sure that their systems treat everyone fairly.

Technology Integration: For story time, [Big Idea 5 - Societal Impact: How AI Can Change the World by ReadyAI](#) is required. Additionally, [Teachable Machine](#) is primarily used to demonstrate how AI learns, specifically highlighting the importance of validation through real-time training and testing with a Smart TV and webcam.

B. LESSON FLOW

The lesson consists of circle time (15 minutes), story time (20 minutes), a whole-group discussion using

Teachable Machine (25 minutes), and a whole-group discussion regarding privacy (20 minutes). It uses presentation slides 70-73.

Circle Time: The teacher starts with the question: “Can you think of a time when AI technology could help us, and a time when we should do something ourselves?” This serves to provoke a discussion on AI’s societal impact later in the lesson.

Story Time: The teacher reads a storybook titled “[Big Idea 5 - Societal Impact: How AI Can Change the World](#)” by [ReadyAI](#). The teacher can incorporate supplemental materials that align with or expand upon the story, such as a video of a self-driving car or other real-life examples of AI.

Whole-Group Discussion using Teachable Machine: This activity comes from students’ ideas about their own future AI. The teacher reminds students, saying, “Yesterday, you shared what you wanted to teach our AI machine. Today, we’re going to help it learn by making categories based on your ideas!”

The teacher and a few students demonstrate how to train a Teachable Machine using 2-3 categories inspired by students’ suggestions. Students test the AI model and discuss whether it has been trained well. A teacher explains: “AI doesn’t really know what something is. It just learns by seeing lots of examples and looking for patterns!” If time is allowed and students would like to try a new thing, utilize voice/movement categorizer as well.

For example, we designed a Teachable Machine activity where students can train the model to distinguish between “fish” and “not fish” using printed images. This idea originated from a student who enjoyed fishing and wanted to create an AI fishing robot:

- Step 1: Students input training data into the machine (see Figure 18).
 - Fish: printed images of different types of fish.
 - Not fish: printed images of trash, non-fish, etc.
- Step 2: Students hit the “training” and wait for it to be completed.
- Step 3: Students test the machine with testing data
- Testing data should be different than the training data (see Figure 19).
- Teacher: Prepare some images of toy fish intentionally to get a teachable moment of AI limitations.



Figure 18. A student training a machine learning model using Teachable Machine.

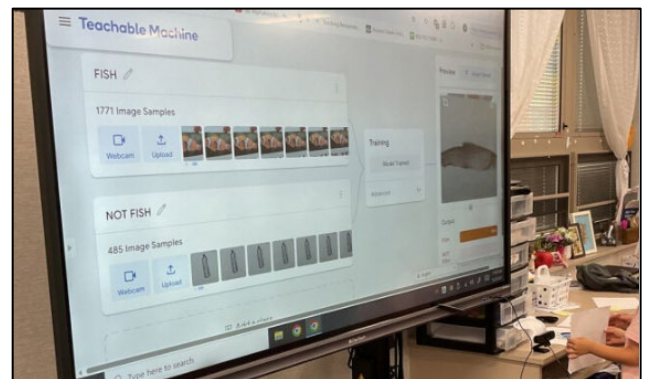


Figure 19. A student testing a machine learning model using Teachable Machine.

In this way, students experience how AI works. Also, they can identify AI’s limitation and the importance of human validation processes with the teachable moment when the machine incorrectly recognizes a toy fish as a real fish.

Whole-Group Discussion regarding Privacy: The emphasis is on protecting yourself and others regarding privacy and AI use. The teacher discusses how AI sometimes uses people’s pictures, voices, and videos to learn. Since they are kindergartners, the materials include icons and images to represent safe sharing, such as no name, no face, and no location, asking, “What should we not share online or with smart computers?”

C. CONSIDERATION

Troubleshooting and Classroom Management: For the setup, it is recommended to prepare two distinct sets of printed images for training data and test data to facilitate hands-on learning. During

implementation, position the webcam at the students' eye level or lower so they can easily hold the printed materials for capture. When a student holds the training button, the teacher may need to assist in maintaining the press long enough to ensure an equal amount of data (e.g., 100 shots) is collected for each category, maintaining data consistency.

Adaptation: What students create with Teachable Machine can vary based on what they drew in a "My Future AI" activity. The teacher then needs to consider how to make these ideas feasible as an in-class activity.

The teachable moment of validation is crucial because it provides a first-hand experience for students to see the limitations of AI, such as when the machine incorrectly recognizes a toy fish as a real fish. Through this, students can see why it is important for us to double-check the information provided by AI. To facilitate this, the teacher can intentionally include specific images designed to confuse the model.

To create a smooth learning experience, using printed images for a whole-group discussion worked better than using digital images. Students can participate in the training and testing process by holding the printed images and hitting the designated buttons. For older students, the teacher could provide the opportunity for them to create their own models using digital images.

Lastly, throughout the curriculum, data privacy can be emphasized not only in relation to AI, but also as part of digital citizenship. In this curriculum, it was used to wrap up the journey at the end, specifically in slides 74–78.

ASSESSMENT PLAN

Our approach to assessment was holistic and qualitative, utilizing diverse methods including observation, artifacts (drawings), and interviews (conversations) rather than structured tests. First, for observation, the teacher and researcher utilized field notes and video recordings for research purposes. However, for feasibility in class, teachers can use the provided rubric/checklist for observations.

Second, student artifacts were utilized to gauge their conceptual understanding; representative examples are included in the "Learning Representation" section.

Below are potential strategies for utilizing these artifacts as assessments:

- Phase 1 (Digital Technology)
 - Student drawings of their favorite technologies and illustrations of proper device care.
- Phase 2 (Representation & Reasoning)
 - Student-created maps utilizing symbols.
 - Personalized symbols designed by students to represent themselves.
- Phase 3 (Natural Interaction & Perception)
 - Student drawings that distinguish between artificial and natural entities, including AI examples.
- Phase 4 (Learning & Societal Impact)
 - Student drawings of their own Future AI.

Lastly, semi-structured interview questions (verbal assessment) were utilized by the researcher to understand students' learning experience. Some examples of these questions are provided, which teachers may adapt to suit their specific classroom contexts.

CRITICAL REFLECTION

REFLECTION ON CURRICULUM

First, the curriculum highlighted students' agency as they took ownership of their learning. For example, they brought up their own questions about AI, shared their ideas about future AI, discussed whether something is AI or not, and created their own machine learning models. This provides a new opportunity for educators and students, showing that AI education can develop core competencies. For young children especially, it is vital to build a foundation for these competencies.

Second, the curriculum was effective because it connected with students' lives and interests. For example, many activities started from students' questions about AI, their responses to certain activities, and their daily lives. Starting from students' interests brings relevant experiences to them, allowing for meaningful discussion among students and teachers.

Third, the curriculum highlighted ethical considerations around AI, and students demonstrated their ability to discuss them and

develop their ethical awareness. For example, students were able to discuss the societal impact of AI on human lives, such as self-driving cars, data privacy, and limitations like misinformation. This curriculum shows that highlighting the human role in AI for young children is feasible and developmentally appropriate.

Fourth, collaborative work between teachers, researchers, and students can leverage the best learning experiences for everyone. A community-based approach to collaboration benefits stakeholders by allowing them to exchange expertise from their respective fields. This also ties back to listening to students' voices by seeing them as active learners.

Fifth, an area for improvement is ensuring enough time for discussion. During implementation, time was occasionally limited due to other structured events and activities within the kindergarten. It would be beneficial for students to have ample time to address their questions and interests regarding the topics.

Lastly, this curriculum did not include much about GAI. In this curriculum, GAI was utilized by the teacher to discuss the roles of AI versus humans during a song-making activity with Magic School AI. There are numerous ethical considerations in GAI, and determining how to introduce these topics in early childhood contexts will be a significant area for future curriculum design research.

IMPLEMENTATION TIPS

First, regarding the timeframe, the curriculum was implemented over nine days between March and May 2025 due to scheduling conflicts between the researcher and the classroom. The total duration may be shorter in other settings. Throughout this period, a cycle of concrete experience and reflection allowed the teacher and researcher to refine subsequent lessons. Specific pedagogical adjustments are detailed in the "Consideration" sections under each activity.

Second, regarding underperformed activities, "Let's Be AI Scientists!" was difficult to execute in 15-minute station rotations, as its core component requires deep research. Students need more time to discuss and investigate their questions about AI. Also, "Let's Make a Song with AI" struggled to convey GAI concepts to students within a short window. We

concluded that more time is needed to clarify the distinct roles of the teacher, the students, and the GAI in the creative process.

Third, regarding student misconceptions and cognitive overload, students sometimes confused general technology with AI. This is understandable, as devices like iPads or smartphones serve general functions while also hosting AI like Siri. However, interviews showed that many students could describe AI in their own words. We did not view this as negative, as we focused more on students' increased interest, curiosity, and critical thinking as a foundation rather than the exact accuracy of the knowledge itself. Also, since this curriculum was spread out over two months, we did not observe signs of cognitive overload among the students, and we ensured recess and lunch were included as break times. There was one case where a student did not want to participate in the Scroobly activity because he thought it was weird, and a few students did not want to share their thoughts during circle time. Their choices not to participate were respected.

Fourth, this curriculum heavily uses internet-based tools due to the nature of AI that is accessible to us. Thus, it is important to check the stability of internet access before activities. If the internet does not work, teachers can focus more on picture books, discussions, and students' own creations rather than tool use. While unplugged activities are a valuable alternative, they are not covered in this version and remain a goal for future work.

Fifth, for accessibility, teachers must verify that school networks do not block tools like AutoDraw, Quick Draw!, or Teachable Machine. Coordination with IT departments is recommended. Furthermore, ensure all devices and Tale-Bots are fully charged. For better accessibility for students, teacher support is important to guide them on how to use the tools while they are learning by doing.

Sixth, for better instructional flow, a team-teaching model (main teacher and assistant) works best. For example, during the Scroobly activity, the main teacher can facilitate the discussion while the assistant handles the recording. If a second teacher is unavailable, high-performing students can assist.

Lastly, the most important tip is to start with your observations of students' interests and connections to your teaching practice. You do not need to implement everything in this curriculum. AI education

is not far from you, and when you look more deeply at your own students and teaching practices, you can find opportunities to integrate AI education into your curriculum.

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SUPPORT MATERIALS

PICTURE BOOKS

- [Children’s books: Tinker Toddlers](#)
 - [Artificial Intelligence for Kids](#)
- [Children’s books: AI and Me](#)
 - [Perception: How AI Sees the World](#)

- [Representation & Reasoning: How AI Makes Choices](#)
- [Machine Learning: How AI Learns](#)
- [Human-AI Interaction: How We Work with AI](#)
- [Societal Impact: How AI Can Change the World](#)

ABOUT THE AUTHORS

Sohheon Yang is a Ph.D. candidate at Indiana University specializing in Instructional Systems Technology. Her teaching practice focuses on early childhood and teacher education, with a particular emphasis on technology integration. Recently, she has facilitated numerous workshops for pre- and in-service teachers on AI education. Her teaching and research aim to foster student/teacher agency.

Anne Winiger is an experienced kindergarten teacher in the Midwestern U.S. with more than 25 years of classroom experience. She possesses expertise across all early learning standards, including English Language Arts, literacy, mathematics, science, and social studies. She values developing students' foundational skills through a playful and ethical learning process.

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Artificial Intelligence Literacy Workshop for Graduate Teaching Assistants

Md Mahbubul Amin, Emmanuel Amackson, Samara Santana, and Mohammad Shams Ud Duha, University of Oklahoma

OVERVIEW

This training program describes a pilot implementation designed to support Graduate Teaching Assistants (GTAs) in developing competency in the responsible and pedagogical use of generative artificial intelligence (GenAI) in their roles as instructors of record in higher education. Guided by Gagné’s (1985) Nine Events of Instruction, Backward Design (Wiggins & McTighe, 2005), and the ADDIE framework (Branch, 2009), the session provides structured instruction in which participants use ChatGPT (5.1) to develop prompt engineering skills and evaluate AI-generated instructional outputs. GTAs construct, test, and iteratively refine discipline-specific prompts using the Role, Task, Context, Format framework (RTCF; Kang et al., 2025) and the AI Assessment Scale (AIAS; Perkins et al., 2024).

Topics: AI Output Evaluation; Generative AI; Prompt Engineering

Time: 2 hours

MATERIALS

- Computers with internet access
- Projector
- [Presentation Slides](#)
- Padlet (or another collaborative note tool)
- ChatGPT (5.1)
- [Printed Materials](#)

CONTEXT-AT-A-GLANCE

Setting

For GTAs in higher education who serve as instructors of record or have other responsibilities in undergraduate courses.

Modality

In-person session

Class Structure

Conducted in a flexible computer lab with individual laptops, shared projection, and movable seating for whole-group modeling, small-group collaboration, and independent prompt experimentation.

Organizational Norms

GTAs had basic familiarity with GenAI tools and responsibility for communicating permissible AI use in their courses. Institutional leadership supported structured professional development in response to emerging AI policy demands (McDonald et al., 2024).

Learner Characteristics

Learners are newly enrolled graduate students at a university in the United States. Learners come from various geographical and academic backgrounds.

Instructor Characteristics

Ph.D. students in learning experience design and technology with expertise in GenAI integration, instructional design, and pedagogical evaluation.

Development Rationale

Many GTAs lack structured preparation to integrate GenAI responsibly into teaching.

Design Framework

Gagné’s (1985) Nine Events of Instruction, Backward Design (Wiggins & McTighe, 2005), and ADDIE (Branch, 2009)

SETUP

The learning environment was designed to be well-lit, and free from distractions, with seating arranged to support interaction (e.g., small groups or a semicircle if discussion or collaboration is expected).

The instructors used 15-30 minutes for effective setup and preparation. This included arranging the physical space, testing audiovisual equipment, logging into digital platforms, loading presentation materials, and conducting a brief check to ensure all learners can see, hear, and access required resources.

CONTEXT AND SETTING

Recent developments in GenAI have introduced both instructional opportunities and pedagogical uncertainty within higher education. GTAs, who frequently serve as instructors of record or lead discussion, laboratory, and grading responsibilities in undergraduate courses, are increasingly expected to make instructional and policy decisions regarding GenAI use. However, many GTAs receive limited structured preparation for integrating emerging technologies into their teaching practice. As a result, decisions about prompt construction, output evaluation, and course-level AI policies are often made without shared criteria, formal guidance, or pedagogical grounding (Davis & Lee, 2023; McDonald et al., 2024). At the time of this pilot implementation, the university did not provide formal training for GTAs on responsible GenAI use in classroom contexts, though discussions were underway with university administrators to incorporate such training into future GTA orientation programs. While many online tutorials demonstrate how to use GenAI tools, few professional development resources focus on how instructors can intentionally design prompts and evaluate outputs within authentic teaching contexts. This gap creates risks of inconsistent policy enforcement, overreliance on GenAI outputs, or avoidance of potentially beneficial tools.

In response, we designed a professional development program centered on prompt engineering as instructional decision-making rather than technical manipulation. Prompt engineering refers to the practice of designing structured inputs that guide AI systems toward producing relevant, accurate, and pedagogically appropriate outputs. In

higher education contexts, prompt engineering functions as a mechanism through which users craft prompts to generate more desirable outcomes, such as improved accuracy, relevance, and instructional applicability (Lee & Palmer, 2025). The conceptual foundation of the program positions prompt construction as a cognitive and pedagogical act in which instructors externalize instructional intent, learning objectives, and constraints to guide AI-generated outputs. The full program was structured as a four-unit sequence spanning foundational AI literacy, ethics and institutional policy, applied prompt engineering, and course-level policy reflection. However, only the Prompt Engineering and Application unit was implemented in a pilot format to evaluate instructional effectiveness, feasibility, and alignment with intended learning outcomes. The remaining units were fully developed but remain conceptual for future full-scale implementation. Table 1 summarizes the structure, modality, and implementation status of each unit.

Table 1
Overview of Program Structure and Modality

Unit	Title	Modality	Status
1	AI Literacy and Foundations	Online Asynchronous	Designed conceptual
2	Ethics and Institutional Policy	Online Asynchronous	Designed conceptual
3	Prompt Engineering and Application	In-Person	Implemented pilot
4	Course-Specific Policy Design and Reflection	In-Person	Designed conceptual

We developed the training program using complementary instructional design frameworks. Backward Design (Wiggins & McTighe, 2005) informed our identification of desired transfer outcomes because the program aimed to develop transferable instructional decision-making skills rather than isolated technical tasks. This approach required prioritizing learning outcomes and assessment evidence before planning instructional activities. Learning objectives therefore focused on enabling GTAs to construct aligned prompts, evaluate outputs using defined criteria, and exercise instructional judgment when using GenAI. We used ADDIE (Branch, 2009) to guide the broader

development process of the program, allowing needs assessment findings, iterative refinement, and pilot evaluation to inform design and implementation decisions. Within this structure, we organized the instructional sequence of the Prompt Engineering and Application unit using Gagné’s (1985) Nine Events of Instruction, which structured the progression from attention and modeling to guided practice, feedback, and transfer during the session. In this design, Backward Design structured the identification of learning outcomes and assessment evidence, ADDIE guided the overall program development process, and Gagné’s (1985) framework organized the pedagogical flow of the implemented session, allowing the frameworks to function as complementary layers rather than competing models.

Needs assessment data indicated that participating GTAs represented diverse disciplinary backgrounds, including humanities, social sciences, STEM, and professional programs, and varied widely in prior experience with GenAI tools. Approximately two-thirds reported experimenting with tools such as ChatGPT (5.1) for instructional tasks, including lesson planning, discussion question generation, and feedback preparation, while others reported minimal prior use. Despite this exposure, about two-thirds expressed uncertainty about how to judge whether AI-generated outputs were pedagogically appropriate, accurate, or ethically responsible for classroom use. Interviews with subject matter experts (SMEs), including faculty mentors and instructional designers, reinforced these findings, noting that many GTAs relied on ad hoc prompting strategies and lacked shared criteria for evaluating AI outputs. These findings informed the pilot session design by emphasizing explicit modeling of prompt construction, rubric-guided evaluation using the AI Assessment Scale (AIAS; adapted from Perkins et al., 2024), and iterative prompt revision using the RTCF framework (adapted from Kang et al., 2025).

The pilot implementation occurred in a technology-enhanced learning lab designed to support active, discussion-based engagement. The physical space included movable seating, individual laptops, shared projection capability, and reliable internet access. This configuration allowed rapid transitions between instructor modeling, paired analysis, independent prompt construction, and whole-group reflection. Because the learning goals required observable performance and revision cycles, the physical and digital environment was intentionally designed to minimize friction and maximize interaction.

The instructional approach emphasized meaning making, structured practice, and iterative feedback rather than passive exposure to AI tools. Participants engaged in real-time prompt testing using ChatGPT (5.1), evaluated outputs using the AI Assessment Scale (adapted from Perkins et al., 2024), and revised prompts based on peer and instructor feedback. The setting supported collaborative problem solving, allowing GTAs to compare outputs across disciplines and reflect on how subtle changes in role specification, contextual detail, or constraints affected instructional quality.

Importantly, although the broader program includes units focused on AI literacy and institutional policy development, the pilot session concentrated specifically on prompt engineering and evaluation competencies. This focus ensured depth of skill development within the available two-hour timeframe and allowed for targeted evaluation of procedural learning outcomes. Future implementations will integrate the conceptual units to provide a more comprehensive professional development sequence.

By situating prompt engineering within authentic teaching responsibilities and grounding design decisions in established instructional frameworks, this session sought to move beyond general AI awareness toward disciplined, pedagogically aligned practice.

LEARNING REPRESENTATION

Unit 3 was the only unit of the training program fully implemented during the pilot and served as the performance-centered core of the instructional design (see Table 1). We implemented this two-hour, in-person session to develop GTAs’ procedural and conceptual competence in prompt engineering and in the critical evaluation of GenAI-generated instructional outputs. During the session, participants engaged in instructor modeling, structured practice, peer evaluation, and iterative revision of discipline-specific prompts connected to their own teaching contexts.

The design of the session followed principles reflected in Gagné’s (1985) Nine Events of Instruction, emphasizing attention, modeling, guided practice, feedback, and opportunities for transfer. Table 2 lists the nine instructional events that guided the pedagogical structure of the session.

Table 2
Gagné’s (1985) Nine Events of Instruction

Event	Gagné’s Instructional Event
1	Gain Attention
2	Inform Learners of Objectives
3	Stimulate Recall of Prior Knowledge
4	Present the Content
5	Provide Learning Guidance
6	Elicit Performance (Practice)
7	Provide Feedback
8	Assess Performance
9	Enhance Retention and Transfer

Presentation of content and materials were delivered through Microsoft PowerPoint to structure the session, highlight key prompt-engineering strategies, and visually model examples of effective and ineffective AI prompts in teaching contexts. Participants also used Padlet as a shared collaborative space to post prompts, review peers’ outputs, and provide feedback during guided practice activities.

LEARNING OBJECTIVES

The learning objectives for Unit 3 are derived directly from prior needs assessment, task analysis, and SME interviews, which identified prompt engineering and AI output evaluation as critical competency gaps for GTAs.

The objectives of this unit were (see Presentation Slide 2):

By the end of Unit 3, participants will be able to:

1. Construct discipline-specific AI prompts using a structured prompt framework that specifies role, task, context, and constraints.
2. Evaluate AI-generated instructional outputs for accuracy, bias, pedagogical alignment, and transparency using the AI Assessment Scale (AIAS)
3. Iteratively revise prompts to improve output quality and reduce ethical or instructional risks.
4. Articulate how prompt engineering supports instructional judgment rather than replacing instructor decision-making.

These objectives reflect higher-order cognitive and procedural outcomes and align with cognitive strategy teaching recommendations (Morrison et al., 2019).

SESSION STRUCTURE AND FLOW

Unit 3 was implemented using Gagné’s (1985) Nine Events of Instruction to ensure that learners were cognitively and motivationally prepared before engaging in independent performance and transfer. The session structure also reflected principles of Backward Design, in which learning objectives and assessment evidence were defined prior to activity sequencing, ensuring that each instructional phase directly supported targeted performance outcomes. In addition, the broader development and refinement of the unit followed the iterative logic of the ADDIE framework, guiding analysis, design, development, implementation, and evaluation of decisions throughout the pilot process.

We intentionally structured the session so that attention and relevance were established early; procedural knowledge was modeled and practiced with support, and opportunities for feedback, reflection, and application were embedded throughout the lesson. This sequencing allowed GTAs to move from guided observation to independent prompt construction and evaluation within a single instructional episode. Table 3 summarizes the structure and timing of the implemented session and illustrates how each phase aligned with Gagné’s (1985) instructional events.

Table 3
Unit 3 Session Flow Aligned with Gagné’s Events

Phase	Time (Min)	Gagné Event(s)
1: Introduction & Orientation	0-8	1-2
2: Modeling Prompt Engineering	8-20	3-5
3: Guided Diagnosis Practice	20-40	5-6
4: Independent Prompt Construction	40-55	6-7
5: AI Output Evaluation (AIAS)	60-80	6-8
6: Iterative Revision	80-90	7-9
7: Pedagogical Integration	90-110	9
8: Closing & Exit Ticket	110-120	2 & 9

PHASE 1: INTRODUCTION AND ORIENTATION

Before beginning the session, each participant was given a copy of the Printed Materials (DOC). After this, the session began by situating prompt engineering within GTAs' everyday teaching responsibilities, explicitly connecting the lesson to common instructional tasks such as lesson planning, assignment design, and student feedback. To activate prior knowledge and surface variation in participants' prior experience with AI tools, we displayed two opening questions on the presentation slides (see Presentation Slide 3) and invited participants to respond through brief whole-group discussion.

- How many of you have used AI to plan lessons, generate assignment ideas, or write feedback?
- How confident were you in the quality or appropriateness of the AI output?

This brief whole-group interaction helped normalize varied levels of experience, reduced affective barriers, and aligned with Gagné's (1985) first event by gaining learners' attention and establishing relevance. We then presented the session objectives and explicitly framed AI as a supportive instructional tool rather than an autonomous decision-maker, a positioning that directly addressed ethical concerns identified through prior SME interviews and learner analysis.

PHASE 2: MODELING PROMPT ENGINEERING

We introduced prompt engineering as a cognitive and instructional design practice that required instructors to externalize their pedagogical intent in ways that generative AI systems could interpret and act upon. We emphasized that effective learning of prompt design requires learners to first observe expert modeling before engaging in independent performance. We explicitly framed prompt engineering not as a technical shortcut, but as an extension of instructional decision-making grounded in learning objectives, learner characteristics, and ethical considerations.

To support this understanding, we presented a structured prompt framework (adapted from Kang et al., 2025) consisting of four components, acronymized as RTCF (see Presentation Slide 4):

- **Role:** the instructional identity the AI should assume (e.g., teaching assistant, tutor, rubric designer).
- **Task:** the specific instructional action to be completed (e.g., generating discussion questions, drafting feedback, creating assessment items).
- **Context:** relevant information about the course, learner level, learning goals, and known misconceptions.
- **Format/Constraints:** expectations for output structure, tone, length, and ethical guardrails (e.g., avoiding answer generation or bias reinforcement).

We explained each component using concrete, teaching-related examples to ensure accessibility across disciplinary backgrounds. We then conducted a live demonstration using two prompts addressing the same instructional task: generating discussion questions for a class on academic integrity, one underspecified, and one deliberately structured using the RTCF framework (see Presentation Slide 5). The weak prompt presented to participants was:

- "Create discussion questions about academic integrity."

In contrast, the structured prompt followed the RTCF framework:

- "You are a graduate teaching assistant preparing a class discussion for a first-year undergraduate course. Generate three open-ended discussion questions about academic integrity and AI use in assignments. The questions should encourage critical thinking, include one short classroom scenario, and avoid yes/no responses."
- **R:** You are a graduate teaching assistant
- **T:** Generate three open-ended discussion questions about academic integrity and AI use in assignments
- **C:** preparing a class discussion for a first-year undergraduate course
- **F:** The questions should encourage critical thinking, include one short classroom scenario, and avoid yes/no responses."

Both prompts were run in real time using ChatGPT (5.1), and the resulting outputs were displayed and compared publicly. During this demonstration, we employed a think-aloud strategy to articulate our instructional reasoning, making the invisible cognitive work of prompt construction explicit and showing how variations in role specification, contextual detail,

and constraints influenced the quality and appropriateness of AI-generated outputs. This modeling phase aligned with Gagné’s (1985) Events 4 and 5 by presenting essential content and providing learning guidance before learners attempted the procedure independently.

PHASE 3: GUIDED DIAGNOSIS PRACTICE

Following the modeling phase, participants engaged in a guided practice activity designed to surface common prompt design errors while keeping cognitive load manageable. Working in pairs, GTAs analyzed pre-written weak prompts drawn from familiar instructional contexts (e.g., “Summarize the Civil Rights Movement;” “Give feedback on this essay”) to identify shortcomings in clarity, contextualization, and ethical framing. Pairs then diagnosed issues such as ambiguity, missing instructional constraints, or lack of guidance regarding appropriate AI assistance and collaboratively rewrote the prompts using the structured prompt framework (see Printed Materials DOC, Common Pitfalls section, for common issues).

During this activity, we circulated among groups to provide immediate formative feedback, pose clarifying questions, and redirect attention to key elements of effective prompt design when needed. Placing this guided practice immediately after the modeling phase supported early skill acquisition by allowing GTAs to apply newly introduced concepts in a low-stakes environment.

PHASE 4: INDEPENDENT PROMPT CONSTRUCTION

Participants then independently constructed two prompts aligned with their own teaching responsibilities (see Presentation Slide 6). The first prompt focused on an instructional design task (e.g., lesson planning, quiz construction, or discussion question development), while the second focused on feedback or tutoring, explicitly incorporating ethical boundaries such as limiting answer generation or requiring guided questioning. To support instructional alignment, we asked participants to begin by pasting a relevant course learning objective into a shared Padlet workspace before drafting each prompt. This shared digital board allowed participants to post their prompts, observe peers’

approaches across disciplines, and comment on each other’s work during the activity.

During this phase, we circulated throughout the room to offer targeted feedback, prompting participants to clarify instructional intent, refine contextual details, and strengthen ethical framing where needed. For example, when a participant posted a prompt such as “Generate quiz questions about photosynthesis,” we asked follow-up questions such as “What level of students are you teaching?” or “What type of thinking do you want students to demonstrate?” to help them revise the prompt using the structured RTCF framework. This activity required learners to apply the prompt framework independently, corresponding to Gagné’s (1985) Event 6 (eliciting performance), while ongoing instructor feedback supported Event 7 (providing feedback).

PHASE 5: AI OUTPUT EVALUATION (AIAS)

Participants then generated AI outputs using their drafted prompts and exchanged outputs with a peer for evaluation. Prompts and outputs were posted on Padlet, allowing peers to review examples across different teaching contexts and provide written feedback. Each peer evaluated the AI-generated output using the AI Assessment Scale (AIAS), adapted from Perkins et al. (2024; see Presentation Slides 7-8). We introduced the AIAS as a criterion-referenced tool for judging both ethical and pedagogical quality, emphasizing its relevance to real instructional decision-making. The scale operationalized evaluation across four dimensions: accuracy, bias/fairness, pedagogical alignment, and transparency. Table 4 summarizes the tool.

Table 4
AI Output Evaluation Criteria (AIAS)

Dimension	Description
Accuracy	Factual correctness and conceptual soundness
Bias/Fairness	Inclusive language and avoidance of stereotypes
Pedagogical Alignment	Alignment with stated learning objectives
Transparency	Disclosure of limitations and uncertainty

Peers used the rubric to comment on specific strengths and weaknesses in the generated outputs. For instance, one peer noted that an AI-generated

discussion question aligned well with the learning objective but lacked contextual constraints, recommending that the prompts specify the course level and desired format of the response. Peers then suggested at least one revision to the prompt that could improve the output on one or more AIAS dimensions. This structured peer-evaluation activity supported criterion-referenced judgment, reinforced ethical awareness, and mirrored the types of evaluative decisions GTAs routinely make when selecting or revising instructional materials (Events 6-8).

PHASES 6-7: ITERATIVE REVISION & PEDAGOGICAL INTEGRATION

Based on AIAS feedback, participants revised and reran their prompts to test the effects of their changes on AI-generated outputs. Revised prompts and outputs were reposted on Padlet, allowing participants to compare initial and revised versions and observe how modifications in role specification, contextual detail, or output constraints affected response quality. Participants were asked to note whether their revisions improved the output on at least one AIAS dimension (e.g., accuracy, pedagogical alignment, or transparency).

This rapid cycle of revision and re-execution reinforced prompt engineering as an iterative design process rather than a static skill. By immediately applying peer and instructor feedback to refine their work, participants strengthened retention and supported transfer, aligning with Gagné’s (1985) Event 9 (Enhancing Retention and Transfer) through learning by application and reflection.

PHASE 8: CLOSING & EXIT TICKET

We concluded the session with a brief exit-ticket reflection designed to promote transfer and integration of prompt engineering into participants’ teaching contexts. GTAs responded in writing to two prompts (see Presentation Slide 9):

1. One concrete change I will make to a lesson, assignment, or feedback practice using AI prompting
2. One way I will use prompt engineering to support my instructional judgment while setting clear boundaries for AI use in my course:
.....

These prompts asked participants to connect prompt engineering to immediate instructional decisions while reflecting on responsible AI use in their teaching practice. We closed the session by reinforcing key principles and encouraging continued refinement of prompts in future courses (see Presentation Slide 10). Representative responses reflected this connection. One GTA wrote, “I will use structured prompts to generate draft discussion questions and then revise them so they match my learning objectives;” while another noted, “AI can help with brainstorming or outlining feedback, but final grading decisions should always come from me.”

EXAMPLE OF PROMPT DEVELOPMENT AND REVISION

The following example illustrates how participants applied the prompt framework during the activity, evaluated AI-generated outputs, and refined prompts based on peer feedback shared through Padlet. The example reflects typical feedback patterns observed during the session, and participant comments are presented anonymously.

Task: Generate discussion questions for a first-year undergraduate course addressing academic integrity and AI use.

Prompt: “You are a graduate teaching assistant preparing a class discussion for a first-year undergraduate course. Generate three open-ended discussion questions about academic integrity and AI use in assignments.”

AI Output: What does academic integrity mean in the context of using AI tools for coursework?

Can using AI tools like ChatGPT ever violate academic integrity policies? Why or why not?

What responsibilities do students have when using AI tools to assist with their assignments?

Peer Feedback: Peers commented on the initial posts, noting: “These questions are good, but they feel a bit general. I think you can include a short scenario so students can evaluate a real situation.” Another peer added, “These look good to me, but I’d probably add a specific example of AI use in an assignment. It might spark more critical reflections.”

2nd Prompt (Building on the First Prompt): “Add a short classroom scenario involving a student using AI to help write part of an essay, and make the questions encourage critical analysis.”

Revised AI Output: Scenario: A student uses an AI tool to generate a paragraph for an essay and then edits the paragraph before submitting the assignment without mentioning the AI tool.

1. In this scenario, do you think the student’s use of AI violates academic integrity policies? Why or why not?
2. What responsibilities do students have when deciding whether and how to use AI tools in their academic work?
3. How might instructors clarify expectations about AI use so that situations like this are easier for students to navigate?

By this stage of the activity, GTAs recognized that prompts could be iteratively refined by adding additional details or constraints to guide the AI toward more relevant and instructionally aligned outputs.

ASSESSMENT

Assessment in this session was formative and performance-based, focusing on participants’ ability to apply prompt engineering principles in authentic teaching contexts. We collected multiple forms of evidence to capture both procedural skill development and transfer-oriented thinking. Evidence of learning included two finalized discipline-specific prompts, AI-generated outputs evaluated using the AI Assessment Scale (AIAS), written peer feedback artifacts, and a brief exit-ticket reflection focused on future instructional application. Representative examples of initial prompts, revised prompts, AIAS evaluations, and exit-ticket responses are provided in the previous sections to illustrate how participants applied the prompt framework and refined their work during the session.

Overall, participant artifacts indicated that all the participating GTAs were able to construct structured prompts aligned with instructional goals and improve output quality through iterative revision. Peer evaluations using the AIAS frequently identified opportunities to strengthen contextual detail, clarify instructional constraints, and improve pedagogical alignment. Exit-ticket reflections further suggested

that participants were able to articulate how prompt engineering could support instructional planning while maintaining instructor judgment and ethical boundaries in AI use.

Table 5 summarizes the alignment between instructional objectives, assessment tasks, and evidence collected during the session.

Table 5
Assessment Alignment for Unit 3

Instructional Objective	Assessment Task	Evidence
Construct effective, discipline-specific AI prompts	Prompt Design Task (2 prompts)	Finalized prompts
Evaluate AI-generated outputs critically and ethically	AI Output Review (AIAS)	Annotated AI outputs
Revise prompts based on feedback	Prompt Revision	Revised prompts and outputs
Articulate prompt engineering to teaching practice	Exit-Ticket Reflection	Written reflection

EVALUATION

Formative evaluation during Unit 3 was conducted through a combination of instructor feedback, peer guidance, and independent practice. We facilitated pedagogically relevant, real-world reflective practice by using performance-based assessment tools, including finalized prompts, written reflections, and revised AI-generated outputs. Each performance artifact was evaluated against its corresponding aligned rubric, allowing us to monitor participants’ procedural accuracy, ethical reasoning, and instructional alignment as learning unfolded.

In addition to evaluating participant performance, we asked the instructors involved in the pilot to provide feedback on instructional effectiveness, feasibility, and implementation considerations. This feedback focused on issues such as clarity of instructions, pacing of activities, facilitation strategies, and the practicality of activities within time constraints. We used these insights to inform subsequent lesson planning and to identify areas requiring additional scaffolding or adjustment in future iterations.

Summative evaluation was informed by cumulative assessment data aligned with the relevant rubrics, as well as thematic analysis of open-ended survey responses addressing both participant learning and instructional effectiveness. Aggregated results were used to determine the proportion of learning objectives met across participants. Following Morrison et al.'s (2019) guidance for evaluating skill-based instructional programs, we examined outcomes relative to the benchmark that programs in which 90% of learners achieve 90% of objectives may be considered highly effective. Assessment results from the pilot were interpreted in relation to this criterion to evaluate overall instructional effectiveness.

Evaluation data from the pilot implementation suggested that the instructional objectives of Unit 3 were largely met. Review of participant artifacts indicated that most GTAs were able to construct two discipline-specific prompts that demonstrated clear instructional intent, appropriate contextualization, and explicit ethical constraints. Comparisons of AI-generated outputs before and after revision showed observable improvement in output quality for many participants, particularly in terms of pedagogical alignment and transparency as defined by the AIAS criteria. Exit-ticket reflections further indicated evidence of transfer, as participants consistently identified specific instructional uses for AI prompting and articulated ethical guardrails they intended to communicate to students.

Taken together, these findings provided preliminary evidence that the instructional design supported procedural skill development and ethical reasoning related to prompt engineering within the pilot context.

CRITICAL REFLECTION

We implemented the lesson once with a small cohort of GTAs who demonstrated varying levels of familiarity with GenAI tools. Review of participant artifacts and exit-ticket responses suggested that the session generally met its intended objectives: participants were able to construct structured prompts, evaluate AI-generated outputs, and revise prompts for instructional tasks. However, the pilot implementation also revealed several design limitations that would need to be addressed in future iterations.

One limitation we encountered involved differences in participants' prior experience with GenAI. For example, during the independent prompt construction activity, several GTAs quickly generated well-structured prompts and proceeded to experiment with refinements, while others needed additional clarification about how to specify roles, contextual information, or output constraints within their prompts. As a result, pacing during the activity became uneven, with some participants waiting for others to complete the initial prompt drafting stage. In future implementations, we would address this issue by incorporating tiered activities, such as providing scaffolded prompt templates for beginners while offering optional extension tasks that allow more experienced participants to explore advanced prompt strategies or disciplinary applications.

A second limitation was related to time allocation during the session. Although the two-hour structure allowed us to model prompt construction, facilitate guided practice, and conduct peer evaluation using the AIAS, the iterative revision phase was shorter than originally intended. Several participants indicated during informal discussion that they would have liked additional time to test multiple prompt variations and compare AI outputs. In future versions of the workshop, we would extend Phase 6: Iterative Revision or assign an additional prompt-refinement activity that participants could complete after the session.

Technology logistics also influenced the session design. Because participants generated prompts and evaluated outputs in real time, reliable access to laptops and internet connectivity was essential. During the pilot, we observed that even brief connectivity delays slowed transitions between activities. If the workshop were implemented in contexts where individual devices are unavailable, we would adapt the activity by conducting instructor-led demonstrations using a shared display and facilitating group analysis of prompts and outputs.

Another important constraint was that this session was implemented as a standalone unit rather than as part of the full four-unit training sequence originally designed for the program. Because participants had not completed the earlier units on AI literacy and institutional policy, we needed to spend additional time clarifying foundational concepts that were intended to be introduced earlier in the sequence. In future implementations, we would integrate the units as originally designed so that participants enter the

prompt engineering session with a shared understanding of GenAI capabilities, limitations, and institutional expectations.

Finally, while the pilot evaluation provided evidence of immediate skill development and participants reflected on how they would integrate the AI prompts into their pedagogy, we were not able to examine how participants actually applied these strategies in their teaching after the workshop (Phase 7: Pedagogical Integration). Future implementations could incorporate follow-up surveys, teaching artifact analysis, or instructor reflections to better understand how prompt engineering skills transfer into authentic instructional practice over time.

Taken together, these reflections suggest that the workshop structure is adaptable across teaching contexts but would benefit from stronger scaffolding, improved time allocation for revision activities, and full integration within the broader training sequence.

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ABOUT THE AUTHORS

Md Mahbul Amin is a Ph.D. student in Learning Experience Design and Technology at the University of Oklahoma and works as a Graduate Research Assistant focusing on instructional design and AI literacy initiatives. His professional experience spans instructional design, language education, and digital learning development across higher education and professional training contexts. His research and professional interests include AI-enhanced learning, instructional design for higher education, language learning technologies, and bridging research and practice to support educators through practical, accessible learning solutions.

Emmanuel Amackson is a Ph.D. student in Learning Experience Design and Technology at The University of Oklahoma. His research focuses on the design and evaluation of technology-enhanced learning environments, with interests in AI-supported training, adaptive learning systems, and game-based learning. Emmanuel is interested in exploring how emerging technologies can be used to personalize learning experiences, foster engagement, and support

meaningful learning across educational and professional contexts.

Samara Santana is a master's student in the Science of Psychology, Research, and Data in Education at the University of Oklahoma and works as a research technician alongside the Center of Child Abuse and Neglect (CCAN) at the University of Oklahoma Health Science Center. As a research technician, her research agenda centers on generating evidence-based level-of-need recommendations that promote youth permanency. This has informed her perspective on how educational contexts can cultivate community and meet the needs of diverse learners through research interests in Universal Design for Learning, visual literacy, and instructional message design that integrates both theory and practice.

Mohammad Shams Ud Duha is an Assistant Professor of Learning Experience Design and Technology in the Department of Educational Psychology at the University of Oklahoma. He earned his Ph.D. in Learning Design and Technology from Purdue University. His research interests include online learning environments, social media in education, open education, Universal Design for Learning, and microlearning. His work has been published in reputed journals such as Online Learning, Distance Education, Journal of Computing in Higher Education, and TechTrends.

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Fostering Pre-service Teachers' AI Literacy: Lessons to Build Knowledge and Confidence

Sohheon Yang, Alyse Harris, and Leonardo Alba-Lopez, Indiana University Bloomington

OVERVIEW

"Teaching with Technology" is an undergraduate course for pre-service teachers (PSTs) across all education majors. This paper details our approach to fostering PSTs' Artificial Intelligence (AI) literacy and confidence by introducing foundational concepts, applications, and ethics. The curriculum integrates interactive digital tools to foster PSTs' engagement and critical thinking regarding AI. PSTs investigate concepts such as machine learning, create custom models using Teachable Machine, explore tools for AI education, discuss ethics, and develop AI guidelines for their future classrooms. Through hands-on activities, discussions, and reflection, PSTs deepen their understanding and demonstrate competency. Desired outcomes include increased AI literacy and confidence. Assessment includes observation of in-class activities and reflections.

Topics: AI literacy, machine learning, AI application, AI ethics

Time: Three 75-minute sessions

MATERIALS & SETUP

- Open classroom space for students to move around in small groups of 3–4 students.
- Computer with internet and a webcam. (A microphone is optional for audio projects.)
- Learning management system
- [Session 1 slides: AI and Machine Learning](#)
- [Session 2 slides: AI Literacy Packet](#)
- [Session 3 slides: AI Ethics and Guidelines](#)
- Poster design program (e.g., Canva, Google Slides)
- Paper and markers or pencils (for physical poster)

CONTEXT-AT-A-GLANCE

Setting

Technology Integration Course for PSTs

Modality

Face-to-face

Class Structure

Three 75-minute sessions across a 16-week course with seven sections, adapted by five instructors

Organizational Norms

This required course prepares PSTs for state computer science standards and technology-integrated instruction.

Learner Characteristics

An average of 24 mostly first-year PSTs. Generally new to AI, with various elementary, secondary, special education, and counseling focuses

Instructor Characteristics

Four doctoral students and one faculty member with diverse teaching backgrounds

Development Rationale

Despite growing research on AI literacy, effective teaching practices remain limited (Lee et al., 2021), posing pedagogical challenges for teachers and cognitive challenges for students (Micheuz, 2020). Consequently, targeted research and instructional strategies are essential to prepare PSTs to teach AI's benefits and limitations effectively.

Design Framework

Experiential hands-on learning addresses (Kolb, 1984).

STANDARDS

This instruction aligns with the ISTE standard for educators 2.6, Facilitator: “Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students” (ISTE, 2024).

CONTEXT AND SETTING

CURRICULUM DESIGN RATIONALE

Over recent years, AI technologies attracted sustained scholarly and public attention due to their expanding capabilities and applications across diverse sectors. These technologies have permeated our lives in numerous ways, supporting a wide range of tasks, from generating written content (Brown et al., 2020) and predicting climate patterns (Domingos, 2015) to supporting medical diagnostics (Holmes, 2019) and enabling chatbot-based and biometric services (Miao et al., 2021). It is not surprising that multiple fields have embraced this technology since it can make our lives easier and encourage economic growth (European Commission, 2020). Education is no exception to this trend.

AI technologies are not new in the field of education. AI-based educational tools can be traced back more than three decades (Du Boulay, 2016). Nevertheless, Artificial Intelligence in Education (AIED) has gone through several AI winters,” periods during which funding and development slowed considerably (Holmes, 2019). This has changed considerably over the last decades with the emergence of more sophisticated computers and big data (Gillani et al., 2023; Holmes, 2019), making AI literacy an essential set of competencies to acquire across any professional field.

According to Long and Magerko (2020), AI literacy is the set of skills necessary to critically evaluate, ethically use, and effectively communicate and collaborate with AI technologies. And although AI technologies are becoming embedded in everyday life and professional practice, society's understanding of these technologies is still limited. Recent studies have highlighted misconceptions and uncertainty surrounding what AI is and how it works (West, 2018).

Thus, the unknowns of AI underscore the need for instructional materials and programs designed to understand both the potential and the limitations of these technologies. In this regard, educators could play a key role as the integration of AI into teaching and learning has rapidly shifted from a speculative idea to more tangible possibilities, leading to transformation in learning settings (Busuttil & Calleja, 2025; Roll & Wylie, 2016).

Recent research has explored how to promote AI literacy in K-12 settings. Ho et al. (2019), for instance, explored the activities that benefit learners’ understanding of what AI is. They found that unplugged activities related to facial recognition and basic robotic exercises positively favor learners’ understanding of AI technology. Van Brummelen et al. (2021) examined how middle and high school students’ perceptions of Alexa change by programming their own agents in AI workshops. Findings showed strong correlations between students’ perceptions of Alexa’s friendliness and trustworthiness, and safeness and trustworthiness. In another study, Kim et al. (2022) explored middle school learners’ evolving perceptions of AI during a summer camp experience. They identified five common perceptions: AI as automation and robotics, AI as a universal solution, AI as inherently intelligent, AI as capable of using all data, and AI as unrelated to ethics. These findings highlight the importance of understanding students’ preconceptions when designing AI curricula for K–12 contexts.

Despite the growing body of research on AI literacy, evidence on effective AI teaching practices remains limited (Lee et al., 2021). Teaching and learning AI concepts still present pedagogical challenges for educators and cognitive challenges for students (Micheuz, 2020). Therefore, additional research and the development of targeted instructional activities and strategies are needed to better prepare both PSTs and in-service teachers to teach about AI technologies effectively.

DETAILED INSTRUCTIONAL CONTEXT

To address the pedagogical challenges that AI poses to educators, we designed a three-session AI module. This was integrated into a technology integration course offered to PSTs in the teacher preparation program at Indiana University Bloomington.

Offered during the fall and spring semesters, EDUC-W 200 enrolls up to 24 students across each of seven in-person sections. Most students are in-state, white, female freshmen. This mandatory course for all education majors allows for interaction with students of diverse backgrounds and varying technological skill levels. Indeed, responses to a technology skills survey based on the ISTE standards, which PSTs complete at the beginning of each semester, have yielded critical information regarding PSTs' technology skills over the past three years. Results have shown us that there are fluctuating levels of technological competence, ranging from basic to intermediate levels. However, we have observed that there is a set of competences that are typically limited among PSTs, AI literacy. Hence, these findings along with the pedagogical challenges that AI technology poses to educators motivated us to design the three-session AI module.

The AI module was designed by three doctoral students of the program in instructional technology. Prior to their doctoral studies, they had accumulated extensive teaching experience across various educational levels, including early childhood, secondary, higher, and adult education. They developed AI literacy through specialized coursework, workshops, and research groups, gaining a foundational understanding of AI mechanisms, applications, and ethics. The team refined the content through weekly meetings and feedback from faculty experts in instructional technology. While main activities occur in class, the course also supports self-directed learning through tool exploration and post-class reflection exit tickets.

The course is organized into five overarching units: 1) foundations, 2) learning experience design, 3) technology integration for various contexts (e.g., assessment), 4) Computer Science (CS) and AI, and 5) data science and contemporary issues. This course, which is taught by five instructors in the instructional technology program (four doctoral students and one faculty member) with diverse teaching backgrounds, aims to equip PSTs with the knowledge, skills, and experiences needed to integrate technology effectively into learning environments. The three-session AI module, which is part of a larger unit focusing on CS, introduces PSTs to foundational concepts related to AI technology, AI in education, and AI ethics. The modules have gone through various design iterations based on our observations of how students respond to the activities and class dynamics, allowing us to adapt

them to student needs and rapid changes of AI technology.

Additionally, through experiential learning, the module seeks to develop PSTs' AI literacy, curiosity, but more importantly, their confidence and familiarity with AI for educational purposes. This is in alignment with the state requirements regarding the preparation of PSTs on CS and technology-integrated instruction.

LEARNING REPRESENTATION

SESSION 1: MACHINE LEARNING WITH TEACHABLE MACHINE

BACKGROUND AND INTRODUCTORY ACTIVITY (25 MINUTES)

The first session focuses on an introduction to AI. This first main activity introduces PSTs to the concept of machine learning using Teachable Machine, a web-based tool created by Google that allows users to build simple machine learning models without needing prior programming knowledge (Google Creative Lab, n.d.).

Before the main activity, the session begins with an introductory activity called *"What Uses AI?"* developed by the AI Goes Rural research team at Indiana University Bloomington (AI Goes Rural, 2022). The activity includes slides titled "What uses AI?" followed by several examples such as Siri, Toaster, industrial robots, Netflix, and more (see Figure 1).

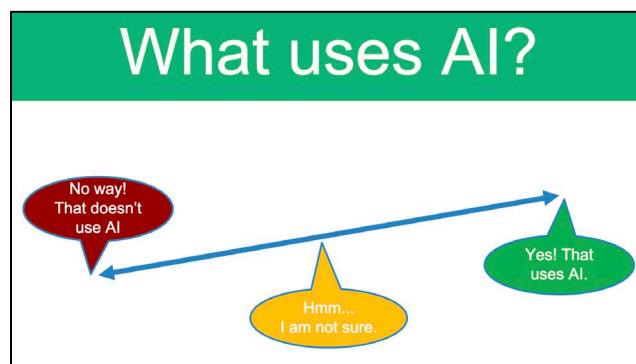


Figure 1. *What Uses AI?* Note. Adapted from "AI vs. Not AI" (pp. 6-17), by AI Goes Rural, 2022, Indiana University. Copyright [2026] by The Trustees of Indiana University.

PSTs move around the classroom based on their thoughts (e.g., front: “Yes! That uses AI,” middle: “Hmm... I’m not sure,” back: “No way! That doesn’t use AI.”). Alternatively, PSTs may use hand gestures from their seats to respond to the instructor’s prompts. The main focus of the activity is not simply categorizing items as AI or not, but rather engaging in discussions about what makes something intelligent. For example, although a regular toaster does not use AI, you can ask PSTs, “If we make an AI toaster, what would make it intelligent?”

After the introductory activity, PSTs are introduced to the basic concepts of AI and the three main types of machine learning: supervised learning, unsupervised learning, and reinforcement learning. At this point, PSTs also learn that AI systems rely heavily on large volumes of data to identify patterns and that the quality of input data significantly affects the output and accuracy of AI models.

MAIN ACTIVITY (50 MINUTES)

Once the instructor introduces the basic concepts of machine learning, they have PSTs move into hands-on exploration using Teachable Machine, focusing on supervised learning. This step serves as the concrete experience stage within the experiential learning cycle. For the first 15 minutes, the instructor demonstrates how to use Teachable Machine with a standard image model. A simple example includes creating a model that classifies happy and sad faces for a quick demonstration, using either a webcam or uploaded images.

- Step 1: Training Data—The instructor labels Class 1 and Class 2 based on the type of model they want to create. They should explain that this represents supervised learning, as labeled data is required to train the model. They should also note that additional classes can be added if necessary. For instance, they renamed Class 1 as “Happy Face” and Class 2 as “Sad Face,” (see Figure 2). They then used a webcam to record sample images of each expression. To build a robust model, they can record their own face as well as several PSTs’ faces.
- Step 2: Model Training—After collecting training data, the instructor clicks “Train the model” to build the model.
- Step 3: Testing the Model—The instructor emphasizes that test data must be distinct from training data. This step offers an opportunity to

discuss the limitations of AI, especially if the accuracy of the model is quite low, and to explore ethical considerations. PSTs consider why the model may have failed (e.g., insufficient or biased training data) and what can be done to improve it (e.g., collecting more diverse data). For example, in the “Happy Face vs. Sad Face” model, a teaching assistant and PSTs not involved in the initial training can be invited to test the model using their own expressions.

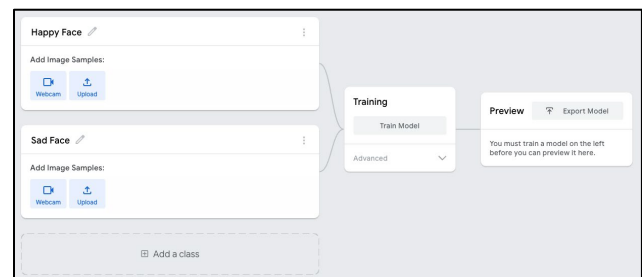


Figure 2. Teachable Machine Interface. Note. From “Teachable Machine,” by Google, n.d.

For the next 20 minutes, PSTs are encouraged to build their own machine learning models individually or in pairs. They are invited to experiment with different project types offered by Teachable Machine, such as image, audio, or pose recognition, and to brainstorm how these tools could be integrated into their future classrooms. While PSTs work on their projects, the instructor goes around to check in and provide personalized feedback. Laptops work best because they have built-in webcams and microphones. If PSTs cannot use laptops for any reason, the instructor should prepare a webcam and/or microphone connected to a desktop in the classroom.

In the final 15 minutes, PSTs share their projects with the class. This step serves as reflective observation of their own work and that of other PSTs, which allows them to further co-construct knowledge of machine learning. In their projects, they frequently used their own bodies (e.g., facial expressions, gestures, poses), nearby objects (e.g., tumblers, glasses), or internet images (e.g., animals) as input data. Figure 3 shows PSTs working on the audio project to build a machine learning model classifying high and low voices.

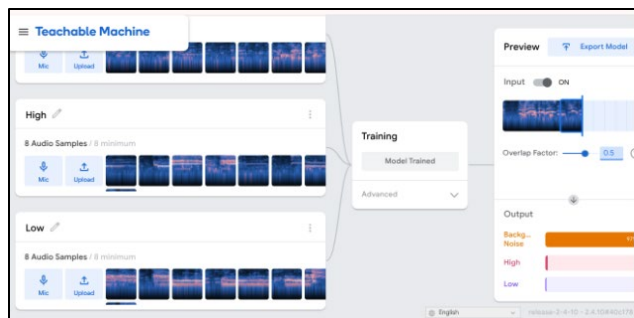


Figure 3. Audio Project Example: High and Low Voices

Figure 4 shows PSTs working on the pose project to build a machine learning model classifying peace signs as class 1 and heart signs as class 2. They also brainstormed ideas for integrating it into the classroom, such as creating different emotions and recognizing them for early elementary students.

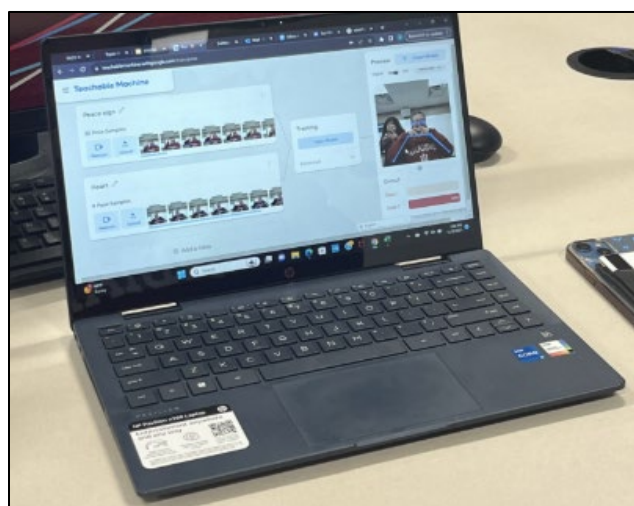


Figure 4. Pose project example: Peace signs and heart signs.

ADAPTATIONS AND EXTENSIONS

The main activity can be flexibly adapted based on instructors' goals, PSTs' needs, or classroom contexts. Below are examples of how the activity might vary in implementation, content focus, or tool use.

First, instructors may pre-select and set up the training and testing datasets based on their instructional objectives. These preselected datasets can be printed out for use during instruction to ensure accessibility for all or saved in a shared cloud folder so that PSTs can download and use them for

their projects. For example, to emphasize ethical considerations, instructors may use the "Introduction to Supervised Machine Learning and Algorithmic Bias" activity from the material "An Ethics of Artificial Intelligence Curriculum for Middle School Students" developed by the MIT Media Lab (2019), in which PSTs examine AI bias by training a model with cat and dog image data using Teachable Machine.

Second, instructors may connect this project with micro:bit for a tangible activity in a workshop called "Teaching and Learning about AI with Tangible Approaches," which was developed by the AI Goes Rural research team (2025). This activity allows PSTs to develop their own machine learning model with Teachable Machine, then extract the model and connect it to a micro:bit so they can see how their machine learning model works with tangible outputs from the micro:bit, such as turning lights on and off using block-based coding.

SESSION 2: TOOLS FOR AI LITERACY

BACKGROUND AND INTRODUCTORY ACTIVITY (25 MINUTES)

The second session focuses on how AI is taught and used in K-12 classrooms. The main activity allows PSTs to explore tools for AI literacy (hereafter referred to as the AI Literacy Packet) that can potentially be used in PK-12 education. The AI Literacy Packet includes a variety of web-based tools, such as AI curricula, generative AI applications, AI-powered tools, machine learning education tools, and educational AI assistants, which are further described in the next section.

Before the main activity, the session begins by introducing the concepts of learning about AI, learning with AI, and the broader idea of AI literacy, defined as "a set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace" (Long & Magerko, 2020, p. 598).

Next, the Artificial Intelligence for K-12 initiative (AI4K12) is introduced. This initiative, jointly supported by the Association for the Advancement of Artificial Intelligence (AAAI) and the Computer Science Teachers Association (CSTA), serves as a national guideline for teaching AI in K-12 schools.

AI4K12 outlines five Big Ideas in AI: “Perception, Representation & Reasoning, Learning, Natural Interaction, and Societal Impact” (AI4K12 Initiative, 2020). PSTs, working in small groups composed of peers from the same major, are encouraged to explore and analyze the AI4K12 guidelines in alignment with their targeted learners’ grade levels. Their discussion is guided by the following five questions (see Figure 5): (1) What do you notice? (2) Is there anything surprising? (3) Is there anything that concerns you? (4) Are there any guidelines that you value most? and (5) Do you have any ideas about how to integrate these guidelines into your future teaching practice?

Figure 5. Instruction on exploring AI4K12 five big ideas.

MAIN ACTIVITY (50 MINUTES)

After instructors introduce the AI4K12 guidelines, PSTs are encouraged to explore the AI Literacy Packet. This serves as the concrete experience of exploring digital tools for AI education. For this main activity, the instructor first creates a slide that includes hyperlinks to various tools. The slide is organized into five areas, as shown in Figure 6.

Figure 6. AI literacy packet.

First, the AI curriculum section includes examples of existing curricula developed by other institutions such as AI4ALL, DAILY AI, and Day of AI. Second, the generative AI section includes AI that allows users to generate text, images, or music, such as ChatGPT (text and image), Canva Magic Media (image), and Suno (music). Third, the AI-powered tools section comprises web-based tools that are powered by AI, enabling users to experiment with tools for diverse purposes, including drawing, music play, and artistic endeavors. They include Quick Draw, Auto Draw, Scribblly, and more. Fourth, the machine learning tools include web-based platforms where users can learn the concept of supervised learning without needing concrete skills in machine learning, such as Teachable Machine and AI for Oceans. Fifth, the educational AI assistant is an AI chatbot specifically tailored for educational settings, such as School AI and Magic School AI.

For the first 25 minutes, the instructor has PSTs, working in small groups, freely explore different tools in each section, and document their ideas about how to integrate these tools into PK-12 classrooms, considering the subject area, targeted learners, learning objectives, a brief description of an activity, and any additional comments, concerns, or questions. This small group leverages reflective dialogue and shared leadership by exchanging their curriculum ideas. During the activity, the instructor encourages them to actually try out the tools and discuss them. For the last 25 minutes, the instructor has PSTs come to the front to share their ideas and demonstrate the tools they chose to the entire class.

For example, PSTs suggested that Quick Draw could be used as a brain break for early elementary students, SchoolAI could be used as a bellringer, and Canva Magic Media could generate background images for stories that their students created in an ELA class. They also demonstrated critical thinking by questioning whether generative AI might replace students’ or teachers’ creativity. Furthermore, they noted that Teachable Machine may not always be accurate and might require re-training, and considering whether some tools are being used merely for fun rather than for educational purposes.

ADAPTATIONS AND EXTENSIONS

This activity can be implemented using different approaches. First, the instructor can demonstrate selected tools before having PSTs explore them

freely. In this case, the activity can be structured so that PSTs follow the instructor’s demonstration and then try the tools themselves.

Also, considering the limited time to cover all digital tools and discuss their integration into the curriculum in one session, the instructor should be flexible in managing it. The session could be spread over multiple days for in-depth discussion, or utilize flipped learning with pre-assigned readings (e.g., real-life examples of AI education with a specific tool) and hands-on experience outside of the classroom.

Lastly, the instructor can design this activity as either a group activity or an individual activity, depending on whether the focus is on group discussion or on individual autonomy in choosing tools.

Additionally, the instructor can use different platforms to provide the AI Literacy Packet. In the example above, we used Google Slides for PSTs to access and try out the tools. Other options include Padlet, and Microsoft Whiteboard (see Figure 7).

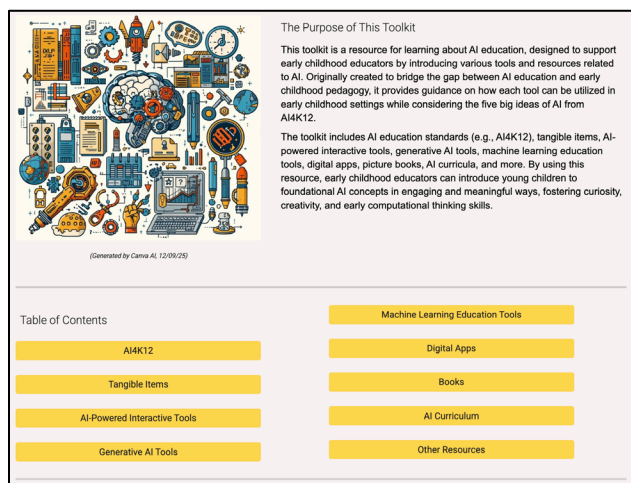


Figure 7. Google Sites for AI literacy packet developed by an instructor.

SESSION 3: DESIGNING YOUR CLASSROOM GUIDELINE POSTER

BACKGROUND AND INTRODUCTORY ACTIVITY (30 MINUTES)

The third session focuses on AI ethics, including topics such as responsibility and ethical use, AI bias, and privacy. The main activity helps PSTs understand

state-level guidelines on AI in education and apply that knowledge to their future classrooms using visualization tools such as Canva, Microsoft PowerPoint, or Google Slides.

Before the main activity, the session begins with a “Which side of the line are you on?” activity. The instructor displays a screen presenting various scenarios that require ethical consideration regarding the use of AI in education. Then, PSTs move to the front (ethical), back (unethical), or middle (unsure) of the classroom based on their judgment for each scenario and share their thoughts and rationale. Here is a descriptive list of the cases (see Figure 8):

- Student: writing a paper
- Student: generating ideas for assignment
- Student: critiquing/giving feedback on own assignment
- Teacher: giving feedback on a student’s assignment
- Teacher: grading students’ work
- Teacher: creating a rubric or a test
- Teacher: creating entire lesson plan
- Student: responding to discussion post
- Teacher: responding to discussion post
- Teacher: writing reference letters for students
- Teacher: creating examples of an assignment
- Student: creating slides for a presentation
- Teacher: creating slides for a presentation
- Teacher/Student: generating art for a presentation:
- Teacher/Student using as a source in research

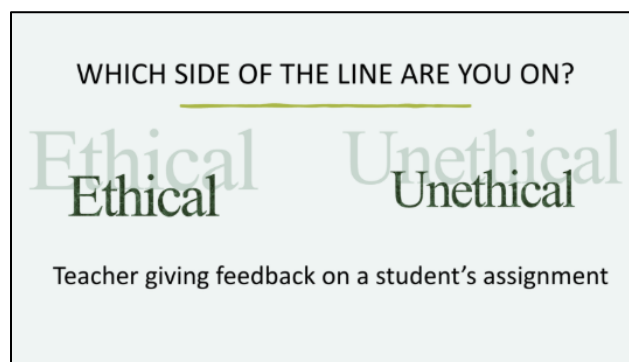


Figure 8. AI ethics: Which side of the line are you on?

MAIN ACTIVITY (45 MINUTES)

Once PSTs look back on their own philosophy on ethical considerations around AI use in education,

they move on to getting to know the state-level AI guidelines. In our case, the Indiana Department of Education (n.d.) provides AI guidelines on its website (<https://www.in.gov/doe/educators/digital-learning>). The materials are shared with PSTs in various ways, such as through a shared cloud folder or a learning management system (e.g., Canvas). Then, they are guided to design their own classroom AI guideline poster in small groups with peers from the same major. This activity incorporated situated learning, as PSTs developed their own AI guidelines within the specific context of their future classrooms. The instructor introduces various materials that could be used for PSTs to create visually appealing posters. For instance, many PSTs experimented with Canva, Google Slides, or Microsoft PowerPoint. The details of the instructions for designing your classroom AI guideline poster are shown in Figure 9.

Group Activity: Designing Your Classroom AI Guideline Poster

- You will draft classroom-specific AI use & responsibility guidelines for a grade level or subject of your choice. Use student-friendly language, visuals, or examples that would help communicate the guidelines to your students. Your classroom guidelines should include:
 - Clear expectations for when and how AI can be used
 - Guidelines for citation and academic integrity
 - Privacy and data protection rules
 - Encouragement for critical thinking and ethical reflection
 - Online etiquette and digital well-being tips
- Consider these criteria while designing your classroom AI guidelines.
 - **Clarity:** Is the policy understandable for the intended student audience?
 - **Comprehensiveness:** Does it address key ethical issues like privacy, academic honesty, and bias?
 - **Practicality:** Can it be realistically implemented and enforced?
 - **Creativity:** Does it reflect the teacher's unique classroom culture or grade level? ↑
- You can refer to the Indiana AI guidance: Please click the first link in the [Digital Learning and Professional Development](#) tab to access it.
- You can use any platform (e.g., Canva, slides, Google Docs, etc.). Share the output on the discussion board.

Figure 9. Instruction for designing your classroom AI guideline poster.

From a classroom observation, it was noted that PSTs attempted to apply their knowledge and express their beliefs about the use of AI in education when composing guidelines for their future classrooms. For example, some secondary education majors emphasized ethical and honest AI use by requiring their future students to share the prompt they used. They also emphasized, "AI is a tool, not a replacement" (see Figure 10).

Others, particularly elementary education majors, took a stricter stance, including guidelines such as "ChatGPT is not allowed unless specifically instructed" and "AI will not be used for research or writing activities" (see Figure 11). Their rationale was that younger students are still developing foundational thinking and writing skills.

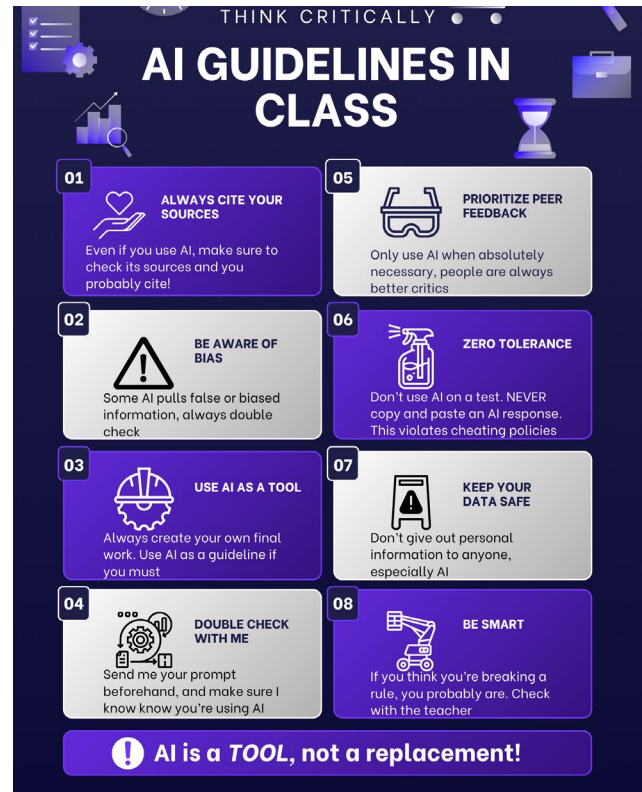


Figure 10. AI guideline from secondary major PSTs.

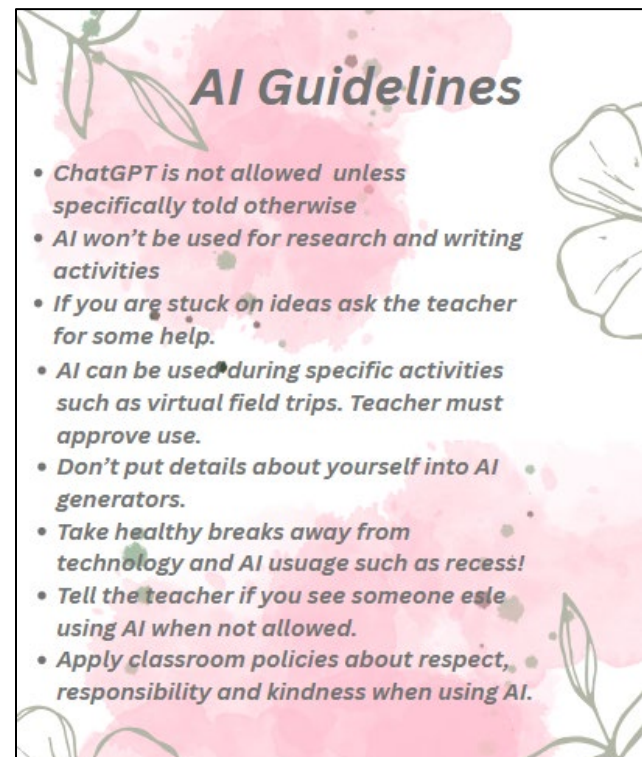


Figure 11. AI Guideline from Elementary Major PSTs

PSTs also went further by addressing issues of plagiarism and the importance of citation to promote academic honesty. They emphasized the need for critical thinking, verifying AI-generated content, and recognizing potential AI bias. Additionally, they highlighted digital privacy concerns, noting that students should not share personal information and should be cautious about their privacy and digital well-being.

ADAPTATIONS AND EXTENSIONS

The instructor provides multiple modes of materials for creating a guideline poster, including both digital and analog options. For example, while some classes offer digital tools such as Canva, Google Slides, or Microsoft PowerPoint, others provide paper, pencils, and markers for PSTs to create AI guideline posters. These options allow for flexible applications depending on the classroom environment or PSTs' preferences for learning materials, whether digital or analog. An example of a paper-based project is shown in Figure 12.

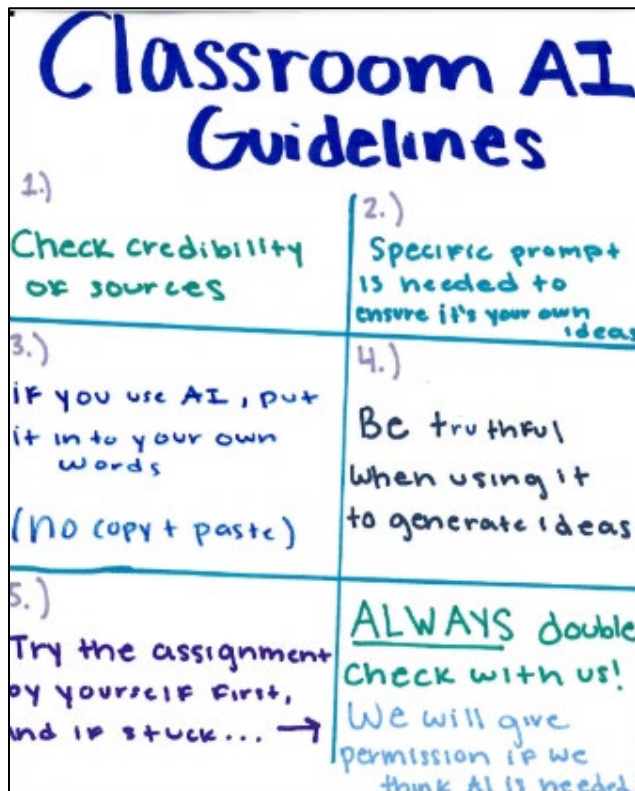


Figure 12. AI Guideline Paper Version.

Regarding AI guidelines, we used the AI guidelines provided by the Indiana Department of Education as a state-level guideline. If other states have different guidelines, those can be used as well. Other options include utilizing existing frameworks, such as the AI Competency Framework for Students developed by UNESCO (2024), which includes four dimensions: “A human-centered mindset,” “Ethics of AI,” “AI techniques and applications,” and “AI system design,” along with three progression levels: “Understanding,” “Applying,” and “Creating.” PSTs would read the materials and develop their own guidelines and philosophy for AI in their classrooms, considering what to focus on.

CRITICAL REFLECTION

REFLECTION ON DESIGNED ACTIVITIES

The design and implementation of the lessons successfully met the goals of our lesson development. Five instructors implemented the lessons seven times during spring 2025. The purpose of these activities is to improve PSTs' AI literacy by enabling them to understand, use, critically evaluate, and collaborate with AI (Long & Magerko, 2020). Each activity works to build foundational knowledge of AI and machine learning and raise awareness of AI ethics and how to apply it in their future classrooms. Considering these goals, assessment opportunities include classroom observations and exit tickets. Overall, our lessons met our primary objective of developing PSTs' ability to critically evaluate and articulate positions on AI use in education. However, objectives related to applying AI tools within concrete instructional designs were only partially met, indicating a need for additional scaffolding.

Two activities were most successful and resonated with students and instructors. The “AI Ethics: Which Side of the Line are You On?” activity was a particular success because of the in-depth discussion it prompted. Students positioned themselves across the spectrum, with some being open to AI use in various forms and others staunchly opposed to AI. Students shared personal examples of times they used AI, including support with learning disabilities, understanding difficult concepts, or just-in-time support for schoolwork. Others shared ethical considerations beyond the scenarios presented, namely, the environmental and social impact of AI

use on the environment, and creative professions such as art and writing. This activity led to conversations about the purpose of education and teachers in society. These discussions synthesized concepts we discussed throughout the unit and created a strong basis for the next activity, where students design a classroom poster articulating their AI Philosophy. The lesson order allowed students to learn the basics of how AI worked before discussions about ethics. By understanding how AI works—using data to find patterns and make predictions, students considered the various perspectives and ethical considerations. These design decisions contributed to successful conversations.

The “Designing Your Classroom AI Guideline Poster” was also especially effective because it allowed PSTs to practically consider what aspects of AI they might address in their own classrooms. This included anticipating the challenges they may face with AI, given the evolving nature of AI in society, as well as the potential benefits for both teachers and students. This activity highlights the way PSTs became familiar with a variety of issues related to AI ethics, reflected on their own values, and connected these insights to their classroom practices. Instructors also identified several opportunities for improvement.

During the second activity, “Tools for AI Literacy,” PSTs generally brought broad ideas about how to integrate tools into their practice. While the activity was effective in exposing them to new tools, the depth of connection to their own practice was relatively limited. Based on this reflection, instructors who are continuing to teach the course plan to adjust the activity by providing PSTs with more time and structure to consider how to integrate a tool of their choice. Instructors designed a lesson design template that included the title, targeted learners, learning objectives, connection to AI4K12 guidelines, and lesson flow. This adjustment enables PSTs to generate more practical ideas and make stronger connections between what they learned and their future teaching practice.

One key area for improvement that emerged was supporting PSTs in making deeper and more meaningful connections between AI tools and their own teaching practice. While the activity was effective in exposing them to new tools, the depth of connection to their own practice was relatively limited. Based on this reflection, instructors who are continuing to teach the course plan to adjust the activity by providing PSTs with more time and

structure to consider how to integrate a tool of their choice. Instructors designed a lesson design template that included the title, targeted learners, learning objectives, connection to AI4K12 guidelines, and lesson flow. This adjustment enables PSTs to generate more practical ideas and make stronger connections between what they learned and their future teaching practice. For example, Figure 13 shows how PSTs designed an ELA lesson integrating “Be My Eyes,” a visual assistance app for blind or low-vision people. This activity included a rich description task where students take pictures and compare human descriptions with AI-generated descriptions.

Group Members	PST's Names
Lesson Title	Describing Daily Life
Grade Level	3rd-5th Grade
Subject Area	Natural Interaction
Learning Objectives	Demonstrate that human language is infinite by showing how any sentence can be repeatedly extended to form a more complex sentence.
AI4K12 Guidelines	Natural Language 4-A-i
Tool you chose	Be My Eyes
Activity Description	
<ol style="list-style-type: none"> 1. The students will test out the tool together as a group choosing a random item/area in the classroom to be described by the AI. 2. After testing out the tool on a few objects or areas, students will choose a new object/area to try to describe on their own. 3. The students will take note of the describing words in their description of their object/area. 4. Write down your description on your whiteboard. After you have added as many details as you can think of as a group, try putting the image into the AI tool. 5. Was your writing more or less descriptive than the AI tool? In what ways could you enhance your writing? What do you need to add? 	

Figure 13. Brief Lesson Plan Integrating “Be My Eyes”

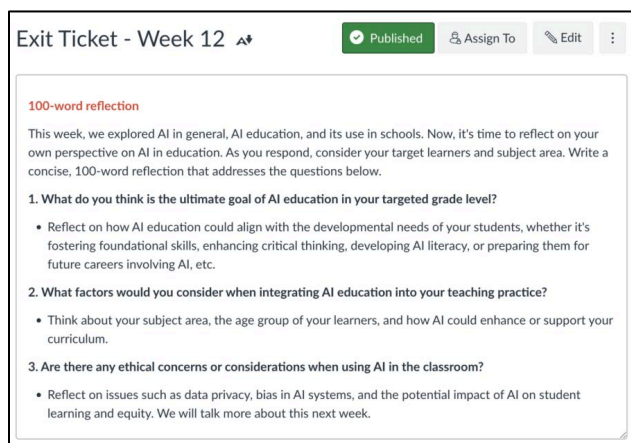
REFLECTION ON PSTS’ ENGAGEMENT AND LEARNING

Throughout the two weeks of classroom observations, we observed PSTs sharing their philosophies on the use of AI in education, demonstrating their ability to understand and critically evaluate AI in educational contexts. They reflected on their current use of AI as college students and their future use of AI as teachers. Interestingly, many expressed critical perspectives on the use of AI, particularly regarding its potential to limit students’ abilities, such as creativity and writing skills, as well as concerns about its environmental impact.

For example, PSTs majoring in visual arts expressed genuine concern about preserving human originality and creativity. While they acknowledged that some digital tools can support the creation and sharing of art, several emphasized their strong belief that human originality and creativity should take precedence over AI and stated that they would avoid

using AI in their classrooms. Similarly, PSTs majoring in English Liberal Arts expressed concerns about the impact of AI on students' writing development. They noted that K-12 is a critical stage for building foundational writing and critical thinking skills. As a result, some wanted to prohibit the use of AI altogether, while others preferred a more balanced approach, encouraging both human and AI-assisted writing while emphasizing the importance of critical thinking, verification, and proper citation. Some PSTs demonstrated awareness of the environmental issues associated with AI, noting that it consumes large amounts of energy, electricity, and water, and raised fundamental concerns about the use of AI itself.

Additionally, the exit ticket asked PSTs to reflect on the ultimate goal of AI education, factors to consider in its implementation, and ethical considerations for using AI in the classroom (see Figure 14). Although the exit ticket was designed after the first two activities and before the deeper exploration of AI ethics, PSTs were still able to share their initial thoughts on ethical issues related to AI.



Exit Ticket - Week 12 ^{AS} Published Assign To Edit

100-word reflection

This week, we explored AI in general, AI education, and its use in schools. Now, it's time to reflect on your own perspective on AI in education. As you respond, consider your target learners and subject area. Write a concise, 100-word reflection that addresses the questions below.

- What do you think is the ultimate goal of AI education in your targeted grade level?
 - Reflect on how AI education could align with the developmental needs of your students, whether it's fostering foundational skills, enhancing critical thinking, developing AI literacy, or preparing them for future careers involving AI, etc.
- What factors would you consider when integrating AI education into your teaching practice?
 - Think about your subject area, the age group of your learners, and how AI could enhance or support your curriculum.
- Are there any ethical concerns or considerations when using AI in the classroom?
 - Reflect on issues such as data privacy, bias in AI systems, and the potential impact of AI on student learning and equity. We will talk more about this next week.

Figure 14. Exit Ticket Instruction

PSTs' reflections varied by major and prior experience. They identified goals of AI education such as developing AI-related knowledge and skills (e.g., how AI works, responsible and ethical use), subject-related skills (e.g., literacy, locating resources), and broader competencies like curiosity, problem-solving, and creativity. In their teaching practice, they emphasized developmentally appropriate approaches, hands-on and interactive learning, playfulness, and limiting screen time for young children. They also expressed concerns about irresponsible or overly reliant use of GAI, cheating,

reduced creativity, privacy issues, environmental impact, human replacement, inequitable access for low-income students, digital safety, fairness, and bias.

IMPLEMENTATION TIPS

Given the number of instructors and the wide variety of student interests, the included activities are designed to be flexible and adaptable across many different contexts and environments. A particular strength of our activities is the "Adaptation and Extension" sections, which offer guidelines to tailor the activities to meet classroom or instructor goals. Instructors implementing these activities should also plan ample time for discussion, establish clear norms for respectful disagreement, and be prepared to facilitate conversations that extend beyond predefined scenarios. Small-group discussion before whole-class dialogue may further support participation from quieter students.

FUTURE MODIFICATIONS

When teaching these lessons in the future, educators could consider several modifications. Currently, the course is designed as a survey course offering a brief overview of many topics. However, AI education and literacy are complex and warrant deeper exploration. The activities described here primarily focus on in-class engagement, but opportunities exist to extend learning beyond the classroom. For example, the lessons could incorporate homework or a flipped classroom model, allowing learners to explore AI tools independently before class without time constraints. Then, class time focuses on collaboration and discussions around how AI tools can be integrated into teaching practice. In our current iteration, some of this reflection occurs in the exit ticket assignment, but integrating this into whole-class or small group discussion could deepen and extend learning.

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ABOUT THE AUTHORS

Sohheon Yang is a Ph.D. Candidate at Indiana University specializing in Instructional Systems Technology. Her teaching practice focuses on early childhood and teacher education, with a particular emphasis on technology integration. Recently, she has been facilitating numerous workshops for pre- and in-service teachers on AI education. Her teaching and research aim to foster learners' agency.

Alyse Harris is an instructional designer and educational researcher. Her teaching and research bridge theory and practice, focusing on practitioner preparation, equitable technology integration, and literacy development. Alyse is a Ph.D. Candidate at Indiana University, Bloomington, in Instructional System Technology.

Leonardo Alba-Lopez is a Ph.D. Candidate in the Instructional Systems Technology program at Indiana University Bloomington. He has 15 years of teaching experience across middle school, high school, and

higher education contexts. His research interests focus on two primary strands. The first explores phenomena related to emergent technologies, digital literacy, gamification, and assessment, particularly in higher education. The second examines issues in teacher education, specifically how preservice teachers make decisions about instructional materials and educational technology integration.

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Sparking Students' Ecocritical Awareness of Generative Artificial Intelligence

Nate Turcotte, Florida Gulf Coast University.

OVERVIEW

This lesson encourages learners to critically evaluate the environmental impacts of popular Generative Artificial Intelligence (GenAI) platforms. Leveraging a technoskeptical approach (Krutka et al., 2019), learners engage in a series of activities that interrogate the relationship between GenAI and environmental sustainability. More specifically, this article describes a sequence of lessons where undergraduates discuss and review research on the environmental demands of GenAI and demonstrate their understanding through a public service announcement and reflection.

Topics: GenAI, Sustainability, Technoethics

Time: Approximately 4, 75-minute class sessions.

MATERIALS

- Internet-enabled computer
- Canva account
- [Suggested Reading List](#)
- [Ecocritical Analysis Activity](#)

SETUP

This article describes a learning activity leveraged in an undergraduate *Introduction to Technology* course that examines the use of technologies for teaching and learning from a sociotechnical perspective.

CONTEXT-AT-A-GLANCE

Setting

An undergraduate education course that explores technology in teaching and learning settings at a large southeastern university.

Modality

Face-to-face.

Class Structure

Twice weekly for 75 minutes.

Organizational Norms

This course attracts a range of majors and interests due to its focus on the use of technology in teaching and learning environments. Additionally, the course is identified with a "Sustainability Course Graduation Attribute" (SCGR), which students are required to earn before graduation.

Learner Characteristics

This is an elective course that attracts a diversity of majors, although education majors make up 75% of the enrollment, on average. Class size is typically 35 students.

Instructor Characteristics

The instructor has a background in critical approaches to education and technology.

Development Rationale

A core element of the university is a strategic emphasis on environmental sustainability. As such, students are required to take and successfully complete an SCGR course. This course requires significant emphasis on sustainability and an appropriate project.

Design Framework

Technoskepticism (Krutka et al., 2019); Skills forward pedagogy.

STANDARDS

This learning experience follows standards and objectives that were developed from the ISTE Standards (International Society for Technology in Education, 2024) and the UN Sustainable Development Goals (United Nations Sustainable Development Goals, 2023). Specifically:

ISTE EDUCATOR STANDARDS

2.3.b Foster digital literacy by encouraging curiosity, reflection, and the critical evaluation of digital resources (ISTE, 2024).

2.3.c Mentor students in safe, legal, and ethical practices with digital tools and content (ISTE, 2024).

UN SUSTAINABLE DEVELOPMENT GOAL

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation (UN, 2023)

CONTEXT AND SETTING

COURSE DESIGN

The learning experiences described in this article overview an activity in an undergraduate course at a large southeastern university. Significantly, there are two university-wide goals and two course goals that frame the design of this course and the learning activity described in this article.

DESIGN ELEMENT 1: SUSTAINABILITY FOCUS

First, one of the core tenets of the university is a focus on environmental sustainability, which is reflected in its strategic plan and a university-wide requirement that all undergraduate students must successfully complete at least one course that has been labeled with a "Sustainability Course Graduation Attribute" (SCGR). To earn this attribute, a course must go through a rigorous review process that includes a review of the course curriculum and a

demonstration of how the course exposes students to sustainability concepts throughout the semester.

The majority of students who enroll in this course are pre-service education majors interested in learning more about teaching and learning with technology. However, since the course was recently approved for the SCGR attribute, a variety of disciplines have begun to enroll in the course, including those in business and marketing, entrepreneurship, and even construction management majors, among others. In turn, the course's exploration of GenAI provides opportunities for the sharing of rich and diverse experiences and perspectives on the topic. For example, education majors frequently discuss the utility of GenAI for lesson planning and brainstorming assessment activities, while students with majors outside of education consider the broad impact of GenAI on their discipline, including labor and business practices.

Among all the majors, these initial perspectives of GenAI tend to be limited to concerns about labor displacement, cognitive offloading, and the devaluation of specific skills (e.g., critical thinking, communication), leaving ample room for students to consider new perspectives and expand their understanding of this technology. I continue to find that, regardless of the major, students are interested and surprised by GenAI's relation to environmental systems, which my conversations with students lead me to believe is a byproduct of the university's focus on sustainability and students' growing concern for planetary sustainability.

DESIGN ELEMENT 2: TRANSFERABLE SKILLS

The university has recently initiated an emphasis on developing students' transferable skills (e.g., critical thinking) for career readiness to help them identify how such skills can be applied across careers and disciplines. To achieve this goal, the university has developed ten digital badges reflective of skills identified by the National Association of Colleges and Employers (n.d.) that align with career readiness. To earn these badges, students must submit at least three artifacts from their coursework, each accompanied by a reflective essay describing the skill and process they engaged in. The artifacts are then reviewed by an external reviewer to determine if a student has adequately demonstrated the skill.

Given this emphasis, the university has encouraged faculty to engage in Skills Forward Pedagogy. That is, a pedagogical approach that prioritizes “transparency” in the learning process (i.e., why students do specific course assignments), the scaffolding of skill development, and authentic assessment (Breslow, 2015).

DESIGN ELEMENT 3: ACTIVE LEARNING

To foster an active learning experience, this course employs design characteristics often associated with a flipped classroom (Lee et al., 2016). As such, students are required to engage with content, including readings, notes, videos, and podcasts, before coming to class. In turn, class time can be spent engaging in discussions and collaborative activities.

DESIGN ELEMENT 4: TECHNOSKEPTICISM

Further, this course embraces a technoskeptical approach to technology (Krutka et al., 2019), which encourages considering more than just the utility of emerging technologies and adopting a critical review of those technologies. While technoskepticism does not advocate for the outright rejection of technologies in teaching and learning settings, it encourages thoughtful interrogations to uncover problematic characteristics (e.g., data bias, surveillance), and in this specific case, the often-invisible environmental impacts posed by GenAI platforms.

PRE-LEARNING ACTIVITY CONTEXT

While the focus of the learning representation is a public service announcement that students complete, the learning experience described in this article typically takes place near the end of the semester and over the course of two weeks. The primary goal of this project is for students to interrogate the ethics of GenAI through an environmental sustainability lens.

By this point in the semester, students have been introduced to emerging technologies, such as GenAI platforms, sustainable frameworks (e.g., the UN Sustainable Development Goals), and critical frameworks for investigating EdTech. As part of the requirements of the SCGR attribute, the students

have already accomplished a series of goals and objectives related to emerging technology and sustainability as required by the university, including:

Goal A: Learners demonstrate fundamental knowledge of issues, concepts, and/or processes related to sustainability.

Goal B: Learners demonstrate the ability to apply knowledge of sustainability issues, concepts, or processes to various contexts.

Goal C: Learners demonstrate the ability to critique, investigate, and connect the relevance, interdependence, and dynamics of environmental, social, and economic systems.

To accomplish these goals, a considerable amount of class time and course content has been devoted to building knowledge about the relationship between emerging technologies and their impacts on environmental sustainability. In turn, students demonstrate that knowledge by designing interventions (i.e., more sustainable practices and/or platforms) and mapping the development of GenAI platforms to environmental, economic, educational, and social systems, all of which are provocative topics in EdTech. For example, there is significant research focusing on the hype promoted by EdTech venture capitalism and its harms across systems (Bender & Hanna, 2025; Komljemovic et al., 2023).

The learning representation illustrates how learners partially accomplish the final goal for the SCGR attribute. This project requires learners to demonstrate their ability to assess the challenges of GenAI to environmental sustainability and work with others to develop solutions.

Furthermore, at this point in the semester, students are aware and tend to be increasingly concerned about how their use of GenAI has planetary consequences. As such, I do not require that students use AI in their work, particularly if a student believes that AI presents more harm than benefit. However, given the availability of platforms with AI-embedded features like Canva, students are free to use it for their projects. To date, I find that the majority of students opt to start with a template or from scratch, and avoid leveraging AI functionality to jump-start their project.

LEARNING REPRESENTATION

In the following, I describe the series of lessons and activities that culminate in an ecocritical investigation of GenAI. The central question that frames this series of lessons is: *What do we want our relationship with GenAI to be like?*

PRE-PROJECT: ESTABLISHING CRITICAL EDTECH THINKING

While the course introduces students to a variety of technologies that are commonly associated with education and PK-16 learning environments, the specific technologies and topic areas are greatly influenced by current trends and students' experiences. As a result, GenAI has been a major focal point of this course over the last two years, and students have been introduced to relevant GenAI systems, research, and concepts throughout the semester. For instance, to build students' understanding, early class sessions describe and explore how algorithms and large language models (LLMs) are leveraged in emerging technologies, such as GenAI. In subsequent classes, students are introduced to relevant concerns prompted by emerging technologies, such as the concept of technology "neutrality," or concerns related to bias in training data, and data privacy and security.

Additionally, students who are unfamiliar with GenAI have opportunities to engage with supplementary tutorials, such as the AI Pedagogy Project (AI Pedagogy Project, n.d.), to build their understanding of how Generative AI functions. Students engage with these tutorials outside of class and in preparation for class discussions. For example, students who are interested in, or have limited knowledge of, LLMs can complete the "AI Starter" and "Explore LLMs" tutorials. Due to the popularity of GenAI platforms, I have increasingly found that not as many students engage with these tutorials. However, if needed, these early efforts can provide students with basic knowledge of how LLMs function.

Notably, the unearthing of prevalent sociotechnical concerns related to emerging technology (e.g., data bias) foregrounds the technoskeptical approach students adopt toward GenAI. Even more, specific course readings (e.g., Robert et al., 2025) and discussions are designed to direct learners' attention

to both the opportunities and challenges posed by GenAI. Further, learners are introduced to scholarship that confronts techno-solutionist views of technology (Logan, 2024; Selwyn, 2024; Wense, 2023). In turn, this framing offers a theoretical approach to emerging technology integration and practical strategies.

Following Krutka and colleagues' (2019) work, students put technoskepticism into practice by analyzing emerging and popular educational technologies. For example, inspired by other technoskeptical accounts (e.g., Krutka et al., 2021), I have students conduct a techno-ethical audit of popular EdTech products like ClassDojo (Turcotte et al., 2024) or MagicSchool AI by asking five critical questions:

1. What does society give up for the benefit of technology?
2. Who is harmed and who benefits from technology?
3. What does the technology need?
4. What are the unintended or unexpected changes caused by the technology? And,
5. Why is it difficult to imagine our world without the technology?

These technoskeptical practices orient students' thinking about popular technology and encourage students to reexamine their regular use of technology and digital media, from Canva to Snapchat to ChatGPT. There is a wealth of curriculum resources provided by the Civics of Technology group (Civics of Technology, n.d.) that can be adapted and repurposed for similar exercises.

CONDUCTING AN ECOCRITICAL ANALYSIS

As students build their understanding of GenAI throughout the semester, their technoskeptical perspective is primarily developed through course readings that explore topics such as the invisible labor, materials, and processes used to create and power GenAI platforms. While it is not possible to list every reading that learners engage with here, they spend several weeks investigating resources (peer-reviewed articles, journalism, popular media) that are dedicated to tracing the environmental impacts of GenAI, from the resources needed to sustain GenAI systems to how much electricity and water these systems use (see Supplementary Reading and Resources list).

CLASS SESSIONS 1 & 2

Following the flipped classroom approach, students engage with resources and write a reflection blog post before coming to class. While I have students pick two readings from the *Against AI and Its Environmental Harms* reading list (see suggested readings and resources) and listen to Husain et al., (2024) podcast episode on the ecological footprint of emerging technologies to support their post. These resources should not be seen as the only resources that can be used to support this activity. Indeed, as GenAI continues to evolve and more critical research is completed in this area, these resources can be exchanged for more current work, including journalism, media, and peer-reviewed studies. In their blog, I encourage students to write about what they know and understand about GenAI's impact on environmental sustainability. Even more, I encourage students to consider: how (and if) the material has influenced their uses of GenAI or their perceptions of how GenAI should be used, and what advice they would provide to family members, friends, and/or teachers who are interested in, or facing pressures to, use GenAI as part of their routine practices.

Class time is spent with learners sharing their findings from the readings, along with their perception of how AI technologies are framed by society, and how (and if) GenAI should be a technology leveraged in educational settings. Additionally, I spend class time introducing issues related to E-waste and planned obsolescence to extend students' thinking about sustainability and their use of "everyday" technology.

Following the first class, our next session is spent contextualizing the environmental concerns in teaching and learning practices. Students work together in groups of 4 to 5 to conduct a "mini" SWOT (i.e., Strengths, Weaknesses, Opportunities, Threats) analysis of a popular GenAI platform (ChatGPT, Claude, etc.) and their impact on society, education, and environmental systems. This activity helps students brainstorm their ideas related to GenAI. Moreover, students are encouraged to document at least five claims for each category (i.e., strengths, weaknesses, opportunities, and threats).

To conduct the SWOT analysis, students can use Padlet or another tool of their choice (e.g., Google Docs) to collaboratively document their findings and perceptions. If students use Padlet, I encourage them

to set their wall up using a "column" or "row" layout and enable the grouping of posts.

In the collaborative resource, students identify strengths and weaknesses for teachers and students, and opportunities and threats for education and environmental systems (Figure 1). Importantly, these findings are based on the students' perceptions more than actual research. As such, for strengths and weaknesses, students typically list using GenAI to brainstorm lesson plans and assessments while drawing attention to concerns regarding academic integrity and cognitive offloading, respectively. For opportunities and threats, which encourage students to think more about the "systems-level," students might note AI's use for monitoring and predicting climate change as well as information access, while issuing concerns regarding the energy and organic material required to support data centers and reductionist views of education and teaching autonomy, respectively.

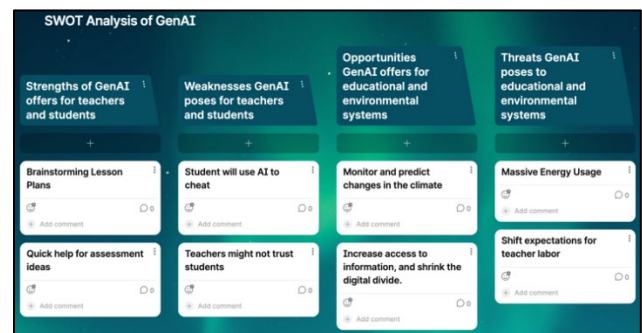


Figure 1. Example of initial student SWOT analysis.

Students return to a similar discussion at the end of class session 4, after they have conducted more purposeful research on the environmental impacts of GenAI. Further, finding inspiration in Logan and Vakil's (n.d.) technoethical audit of ChatGPT, I then have students discuss whether their chosen GenAI products should be implemented into PK-12 educational settings. These discussions are typically lively and full of passion as students consider the range of possibilities (and harms) that their chosen platform may have in PK-12. In general, the goal of this discussion is for students to broadly consider the ethical and moral dimensions of GenAI and its implications for teaching and learning practices, from helping with brainstorming to shifting expectations for teachers.

After discussing their SWOT results, preparation for the following week includes a dive into ecocritical

approaches to EdTech. In turn, students read Werse’s (2023) call for an ecocritical approach. Significantly, an ecocritical approach to EdTech mirrors the goals of technoskepticism in that it is both a critical exploration of technology and an attempt to unearth the inherent (and unintended) tradeoffs that are made for the technology. While technoskepticism grounds the students’ exploration and discussion of technology in this course broadly, an ecocritical awareness directs students’ criticality on the ecological impacts of a technology during its lifespan, from production to disposal (Werse, 2023).

CLASS SESSIONS 3 & 4

Students can complete the research aspect of this project either individually or in groups of 2-3. However, students are responsible for creating their own final product, a public service announcement (PSA) that raises awareness of the often “invisible” environmental harms posed by GenAI. For this PSA, students need to locate at least 10 resources that will support a total of at least five findings that users of GenAI should be aware of. While I recommend that students create their PSA using Canva, they are free to use any graphic and/or image maker of their choice.

Typically, at least the first half of class 3 is spent introducing and discussing PSAs, including how to design a graphic for optimal viewing and ease of information awareness. During this discussion, I share examples of public service announcements found online, and, as a result, we collaboratively develop standards for creating a coherent and well-designed graphic. For example, students often suggest that the graphic should:

- Clearly identify a theme or central point.
- Be easy to read and understand.
- Use images, graphs, and maps to display information.
- Be grounded in research.

Throughout the remainder of the class, students start working on their project. Students are encouraged to identify an environmental aspect they are interested in (e.g., GenAI water consumption, materials used to create technological components, such as lithium) and locate research through peer-reviewed sources or popular media (e.g., Against AI and Its Environmental Harms, see suggested reading list) that can support the design of their PSA. On average,

students require 5-6 hours for research and the completion of their public service announcement (Figure 2).

During the final class of this series, students present and discuss their PSAs to each other, identifying “what they found really interesting,” “what challenged their thinking,” “what they will do differently now, if anything,” and “what alternative solutions might exist.” Additionally, students return to their earlier SWOT analysis about GenAI in education and contextualize their initial perceptions in their ecocritical analysis. Further, I encourage students to consider how their views may have shifted, along with how their advice for educators, school leaders, and policymakers has changed.

A final reflection paper complements the students’ PSAs. In this paper, students reflect on their research process, expand on their research findings, and discuss how the project demonstrated their critical thinking. Since students are expected to submit their PSA for the Critical Thinking Digital Badge, students reflect on how both their content knowledge and their artifact demonstrate their skills development.

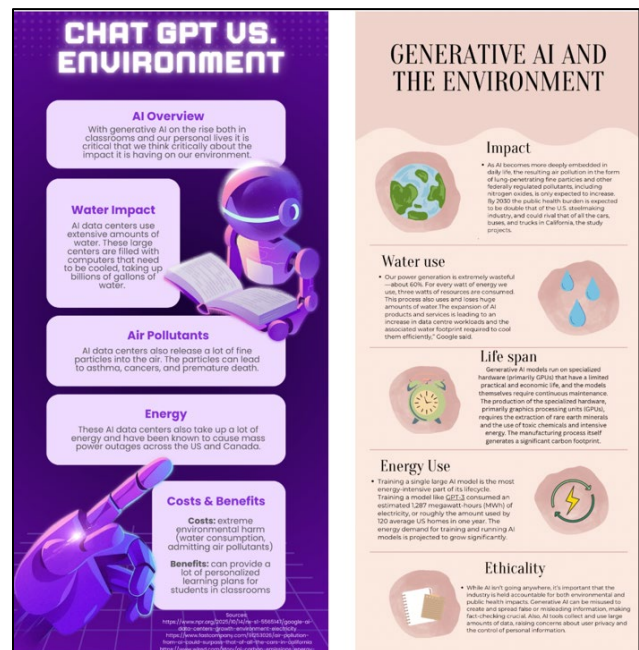


Figure 2. Student PSA Examples

CRITICAL REFLECTION

This learning representation was implemented in both the spring 2025 and fall 2025 semesters, across four course sections. While the learning representation has evolved over those four sections to meet the goals of the university (e.g., Transferable Skills, learning about sustainability across disciplines), the core focus of the activity has remained the same. That is, while the logistics of how the activity was implemented in each semester shifted depending on class size and students' interests and knowledge of material, the activity outcomes remained the same. For example, as students become increasingly aware of the environmental impacts of GenAI (e.g., the resource-intensiveness of data centers), I have been able to spend less class time introducing and identifying these characteristics through readings and class discussions. Based on my experience, I highlight three elements that I believe have contributed to, or can contribute to, more meaningful class discussions, student learning, and student projects.

When I originally implemented the SWOT analysis activity and the following discussion of findings, I provided very little framing for how students should discuss their perspective. While the discussion of whether GenAI should be implemented into schools was always relevant and engaging, I often found that students were overwhelmingly hesitant to the idea of incorporating it into K-12 settings, and for the most part, suggested that schools should avoid the technology. Across the four course sections, there have been one or two students who dissent from the majority opinion, but their ideas, whether they are justified or not, tend to be overlooked because of the lack of clear support from their peers. I sense that other students share similar views, especially among the majors outside of education. So, in an attempt to encourage a deeper dialogue and potentially offer a safer environment to share ideas, I plan on shifting this discussion to a debate format. For this, I plan to assign debate teams, and I will assess whether this process will enable the sharing of more contrasting opinions without the fear of being judged, since students are *assigned* to share a specific perspective.

Second, while I have enjoyed the infographics that students create, this activity could be expanded to accept different types of artifacts (e.g., Op-Eds/News articles, video-based interviews or stories, class

presentations) depending on how much class time is available. I have yet to require projects such as these due to the additional amount of time that would be required of the students. Since this project typically occurs at the end of the semester, and they complete multiple other projects in my class, I have opted not to require a more technical or demanding project. Relatedly, I could also add an opportunity for students to review and critique their peers' PSAs in an effort to help alleviate some of the feedback that I offer on their final artifact. While this would also take additional time, it could help streamline the Digital Badge submission process for students and reassure them of the quality of their artifact.

Third, I have provided a lot of flexibility with how the learning representation is structured on purpose. That is, students can choose to work together, they can choose to use class time to work on their project, and they can choose different areas of focus for their ecocritical analysis. The first time I implemented this project, the audience for the PSAs was schools, administrators, and teachers. However, due to the diversity of the course's enrollment, that is, not all students are education majors, students now create a PSA for an audience of their choosing. The only caveat is that the PSA must connect with elements of environmental sustainability and awareness.

Furthermore, while I have suggested using approximately five hours of class time for this activity, the learning representation could be condensed or expanded depending on the expertise level of the students. The majority of students enrolled in this course are first and second-year students, and very few have taken a previous course on emerging technologies or environmental sustainability. As such, students' knowledge of these two systems could greatly impact how much time is needed to complete the learning representation.

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ABOUT THE AUTHOR

Nate Turcotte (He/Him) is an Associate Professor of Teacher Education and Learning Sciences at Florida Gulf Coast University. He studies technology-rich forms of teaching and learning across formal and informal learning settings. He teaches undergraduate pre-service educators how to examine and evaluate technology for educational purposes. He also teaches graduate courses in educational technology and design.

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Taking Ownership of Gen AI: Connecting AI and Ethics for Undergraduate Students

Jasmine Thomas, Ernest Anderson, and Elisabeth B. White, Towson University

OVERVIEW

This unit consists of two lessons and a corresponding assignment designed to help undergraduate students in an information literacy elective course to reflect on what ethical use of generative artificial intelligence (Gen AI) means to them. Students participate in lectures and discussions about information ethics and Gen AI over the course of two weeks. Then, they complete a Personal AI Framework Assignment in which they reflect on their ethical beliefs, how AI is affecting their daily lives, and what they consider to be acceptable and unacceptable uses of AI in academic and professional contexts.

Topics: information ethics, artificial intelligence

Time: Two 75-minute class sessions and one written assignment that students complete outside of class.

MATERIALS

- Projector
- Dry erase boards and markers
- Sticky notes
- Pens
- [Personal AI Framework Assignment Description](#)
- [Information Ethics Session Slides](#)
- [AI Session Slides](#)

SETUP

Groups of 4-5 students sit at tables arranged to view the instructor station and a screen. Each group gets a small dry erase board for Lesson 1. In both lessons, the class accesses a rolling dry erase board to place sticky notes during the icebreaker. Five minutes before lessons, instructors place supplies on tables.

CONTEXT-AT-A-GLANCE

Setting

Large public university in the Mid-Atlantic region of the United States.

Modality

Face-to-face

Class Structure

Two 75-minute class sessions, with a corresponding reflection assignment. Students were seated in groups of four to five.

Organizational Norms

The course is an information literacy elective taught by library faculty that can be taken to fill a general education requirement. The library is a campus leader in teaching AI ethics.

Learner Characteristics

25 undergraduate students from a variety of majors with all class years represented.

Instructor Characteristics

Instructor 1 is a Research and Instruction Librarian with 3 years of experience. Instructor 2 is a Research and Instruction Librarian with 2.5 years of experience. Instructor 3 is the Head of Library Teaching with 7 years of experience.

Development Rationale

Instructors wanted students to critically reflect on the ethical use of AI and make informed decisions about how they will use (or not use) Gen AI in the course.

Design Framework

Transparency in Learning and Teaching (TILT); Association of College and Research Libraries (ACRL) Framework for Information Literacy for Higher Education.

STANDARDS

Transparency in Learning and Teaching (TILT) (Winkelmes, 2026):

- Discuss assignments' learning goals and design rationale before students begin each assignment
- Gauge students' understanding during class via peer work on questions that require students to apply concepts you've taught

Association of College and Research Libraries (ACRL) Framework for Information Literacy in Higher Education (ACRL, 2016):

- Authority is Constructed and Contextual
- Information Has Value
- Information Creation as a Process

CONTEXT AND SETTING

The lessons and corresponding assessments took place in the context of a semester-long course: LIBR 300: The Information Experience. This course is an elective that students may take to fulfil a general education requirement relating to exploring ethical perspectives. The course is designed to help students explore the intersections of research and ethics and apply that understanding to a personalized research project that they complete throughout the semester.

The course was first offered in Fall 2022 and is offered every semester. The class usually has students from all class years and a variety of majors. In its most recent implementation, there were 25 students in the course: 10 freshmen, 5 sophomores, 6 juniors, and 4 seniors. The most common majors of enrolled students were pre-nursing, exercise science, and information technology.

The course underwent significant revision prior to the Fall 2025 semester to provide students with more opportunities to critically reflect on how artificial intelligence is affecting the library and information science field and academic research in all disciplines. Although the course only had one instructor of record in Fall 2025, three instructors took part in planning and delivering AI-related course

content. Instructor 1 is the instructor of record. She taught the class session on information ethics and helped design the related assignment. Instructor 2 gave a guest lecture on AI ethics and helped design the assignment. Instructor 3 provided oversight for the course, helped design the assignment, and created the assignment grading rubric.

In prior semesters, LIBR 300 instructors raised concerns that some students did not properly document their Gen AI use on course assignments and that some students used Gen AI in ways that were unethical and/or counterproductive to their learning (eg: submitting assignments with confabulated sources). To address this concern, we developed new class activities and a new assignment to help students understand the advantages and disadvantages of using gen AI in academic contexts. Our goal was not to discourage Gen AI use outright, but rather to guide students to make informed choices about how to use Gen AI in ways that align with academic standards and their personal ethical beliefs. To that end, we moved class sessions on ethics and AI much earlier in the semester (now beginning in week 2) and created a Personal AI Framework Assignment in which students were asked to provide examples of what they believed to be acceptable and unacceptable uses of AI based on their personal ethical beliefs.

The Personal AI Framework Assignment was designed using principles from the Transparency in Learning and Teaching (TILT) framework (Winkelmes, 2026). We wanted to make sure that students understood not only how the skills they practiced and developed through this assignment would help them succeed in this course but also how they could apply them in future academic, professional, and personal contexts. We made this goal explicit in the assignment description: "This assignment will help you think about your personal ethics and prepare you to make informed decisions about using AI in your personal and professional life." We also followed TILT guidelines by setting clear expectations, using a detailed grading rubric that was shared in advance, and providing an example assignment.

In addition, we aligned the goals of our class sessions and the corresponding assignments with three threshold concepts from the Association of College and Research Libraries (ACRL) Framework for Information Literacy for Higher Education (Association of College and Research Libraries,

2016). The ACRL Framework is a guiding document used by academic libraries to facilitate student growth in fundamental skills relating to information literacy. Our lessons approached the Authority is Constructed and Contextual frame by asking students to reflect on questions of authorship for AI generated work and consider how Gen AI use affects perceptions of source credibility. We addressed the Information Has Value frame by discussing the costs of Gen AI use, including economic and environmental effects. Finally, we had students explore the Information Creation as a Process frame by prompting them to consider how Gen AI might fit into their own research process.

LEARNING REPRESENTATION

The learning representation began in Week 2 of the semester with Lesson 1: Information Ethics. This lesson consists of an introduction to information ethics and a discussion about the rationale and guidelines for the Personal AI Framework assignment. The following week, Instructor 2 led Lesson 2: AI Ethics. This lesson was designed to explain how Gen AI works and help students think through the ethical issues associated with Gen AI. Students submitted their Personal AI Framework assignment at the end of Week 5. The class sessions between the AI ethics lesson and when the assignment was due did not directly relate to the assignment, but we made the assignment due in Week 5 to ensure students had time to reflect and process their thoughts before submitting. The two lessons and one assignment align with two of the course's learning outcomes:

1. Students will explore ethical issues in the library and information science field and reflect on how their own ethical perspectives affect their information seeking behavior
2. Students will develop, implement, and revise a personalized research process to address an information need.

PERSONAL AI FRAMEWORK ASSIGNMENT

The assignment (Personal AI Framework Assignment Description) was designed to have students think about their ethical perspectives and beliefs about AI, especially generative AI, to guide how they will use it in the course. The assignment consisted of three

sections and there was no minimum or maximum word count because we wanted to give students the space to make their framework true to them.

The first section asked students to discuss their personal ethical beliefs by thinking about their identities, upbringing, and morals. This section was intended to have students reflect on who they are and how they decide what is ethical.

Next, students were asked to address the ways that AI showed up in their daily life and how they used it in their day-to-day work. They also shared something positive about AI and an ethical concern about AI.

For the last section, they created their Personal AI Framework by connecting their ethical reflection and perspectives on AI. Their framework included a summary of their ethical beliefs about AI and two examples of acceptable AI use and unacceptable AI use in school. They were asked to explain why they deemed their examples acceptable or unacceptable as well.

Students were also required to submit a Gen AI statement with every assignment. In the statement, students either indicated how they used Gen AI (and the prompts they used to get their results) or stated that they did not use Gen AI at all. Guidelines for the Gen AI statement also listed ways that students were not permitted to use Gen AI in the course, including:

- AI hallucinations, false information, or fake sources in your assignment.
- Pasting assignment descriptions and class content into AI tools.
- Presenting AI generated work as solely your own.
- Prompting an AI tool to complete an entire assignment for you.

LESSON 1: INFORMATION ETHICS (75 MINUTES)

Lesson 1: Information Ethics was designed to contextualize the entire course and prepare students to complete Section 1: Personal Ethical Reflection and Section 3: Personal AI Framework of the Personal AI Framework assignment. By introducing ethical frameworks and concepts in information ethics (Information Ethics Session Slides), students were equipped with the ability to reflect on and articulate their ethical perspective.

This lesson was connected to the course’s first learning outcome: Students will explore ethical issues in the library and information science field and reflect on how their own ethical perspectives affect their information seeking behavior. In addition to the course learning outcome, Lesson 1’s learning outcomes were as follows:

1. Students will explore ethical issues related to information creation, access, and use.
2. Students will reflect on their own ethical perspectives as it relates to information.
3. Students will create an Information Code of Ethics to ground their approach to research in the course.

LECTURE & CLASS DISCUSSION (45 MINUTES)

Instructor 1 began the lesson with a lecture about information, various information formats, and information literacy. Next, the instructor discussed various ethical frameworks (e.g. utilitarianism, care ethics). Remaining time was spent exploring issues in information ethics. Burgess (2019) writes that “information ethics is the story of the good that can be accomplished with information, and all the ways it may be used to harm.” The instructor shared this definition then asked students to think about the ways information may help or harm people.

Next, the instructor provided an overview of some major themes in information ethics (e.g., access, ownership, privacy, and security) and shared examples from the news to help explain the themes. To discuss information access, the instructor used TikTok’s content moderation policies and the suppression of Black creators and content about racial injustice as an example (Rosenblatt, 2021). Then the instructor posed a discussion question for the group to discuss: Are there any instances where limiting one’s access to information is appropriate?

GROUP ACTIVITY: INFORMATION CODE OF ETHICS (30 MINUTES)

Following the discussion about various ethical issues related to information, students worked in their small groups to create an Information Code of Ethics. This group activity was created to support students’ abilities to complete the Personal AI Framework

assignment by asking students to think about what ethical information and AI use look like.

Students were given the following prompt:

Imagine you have to create standards for ethical information creation and use today. What would you include? Consider the following questions:

- What does it mean to ethically engage with information?
- What are the ways that information is used for good? What about harm?
- What ethical issues related to information come up during research? What about your day-to-day?
- How does information impact society?

They were also given a list of ideas to help them get started. This included topics such as artificial intelligence, plagiarism, misinformation, and more. The instructor provided each group with a dry erase board and markers to write their Code of Ethics.

After completing the activity, each group took turns sharing their Information Code of Ethics with the rest of the class. The larger class then worked together to identify similarities and points they agreed with to create a Code of Information Ethics to guide them for the rest of the semester. Below is the Code of Information Ethics that the class came up with for the Fall 2025 semester:

1. The way we interact with information should be responsible, honest, and respectful.
2. We will aim to use and create credible information and avoid spreading misinformation.
3. We want to protect people’s privacy and be transparent about data collection and use.
4. We want to lower barriers to accessing information to ensure that information is available to all.
5. We will always give credit to others for their work and ideas.

LESSON 2: AI ETHICS (75 MINUTES)

Lesson 2: AI Ethics took place the following week. This lesson was developed to introduce students to ethical issues connected to AI and prepare students to complete Section 2: AI Use and Section 3: Personal AI Framework of the Personal AI Framework assignment. The second lesson supported the first course learning outcome:

Students will explore ethical issues in the library and information science field and reflect on how their own ethical perspectives affect their information seeking behavior. The following were the learning outcomes for Lesson 2:

1. Students will explain their personal perspectives relating to the ethical concerns associated with each stage of development for AI technologies.
2. Students will describe how algorithmic bias can emerge from an AI system's data and learned patterns.
3. Students will identify guiding questions that inform their ethical use of AI in the context of their academic work.

This lesson featured a debate, guest lecture, and group discussion. Once again, students sat in small groups of five, which they chose.

GROUP ACTIVITY: INFORMATION ETHICS DEBATE (30 MINUTES)

Throughout the semester, students participated in mini debates about an issue related to information ethics. These debates were intended to help students speak persuasively about an issue and introduce a concept to their classmates. For this class, debate participants argued whether professors should be allowed to use Gen AI tools to design lessons and grade assignments.

PRE-GUEST LECTURE ICEBREAKER ACTIVITY (10 MINUTES)

Following the in-class debate, Instructor 2 conducted an icebreaker activity to lead into the guest lecture as well as to gauge students' knowledge and beliefs around the topic of Gen AI. The instructor asked two questions:

1. What is one thing you already know about AI & Ethics?
2. What is one thing you want to know about AI & Ethics?

Students chose which question to answer, wrote their response on a sticky note, and attached it to one of two sections of the dry erase board at the front of the room (corresponding to the correct question). Regardless of which question students chose to answer, their responses shaped the direction of the

lecture and class discussion to reflect their areas of interest. Their responses were read aloud in class, but student's names were not attached to their answers.

There were fifteen responses in total (two students chose to respond to both questions). One out of every three responses approached the topic of AI and ethics as a question of individuals' personal use of Gen AI tools. Of those, two framed ethical AI use in a classroom context, one framed it in a workplace context, and two discussed potential inaccuracy as a point of concern in personal Gen AI use.

The other two thirds of responses approached AI and ethics on a broader level than individuals' use of this technology:

- Five students identified specific ethical concerns related to AI: bias, copyright, environmental impact, AI in healthcare, and trust/safety.
- Two students talked about the popularity of Gen AI tools in the current moment.
- Three students responded with broad requests for more context around AI technologies. Of those responses, one framed the request in terms of forming their personal opinion about AI; one wanted to know about "the dark side" of AI, and one had questions about how machine learning worked.

GUEST LECTURE & CLASS DISCUSSION (35 MINUTES)

After the icebreaker, Instructor 2 used slides to present a guest lecture and class discussion (AI Session Slides). This portion of the lesson began with a brief explanation of how Gen AI tools generate new content mirroring patterns found in training data and facilitated small-group discussions about how various ethical issues arise at each stage of a tool's development (e.g., copyright concerns tied to where and how training data is collected, concerns about bias tied to which patterns emerge during training). This discussion was structured as a pair-share activity.

The lecture included additional sections for student discussion. The first was a comparison of two case studies where a machine learning system used or developed for the medical field replicated a harmful bias in its conclusions/output. Context was given explaining the difference between predictive and

generative AI models. As a class, students were asked to theorize about what pattern in the training data could have resulted in that biased output, discuss the risks of using biased models, and share their thoughts on human oversight in automated decision-making.

At the end of the session, students were asked to participate in small-group discussions about what ethical concerns they would want to address before they would be comfortable using a Gen AI tool in their academic practice. Students shared their conclusions with the group. Many of the students brought up environmental concerns and privacy, and one student said they would not be comfortable using Gen AI in their academic work at all. These small-group discussions were intended to prepare students to further explore these concepts in their Personal AI Framework Assignment.

CRITICAL REFLECTION

Our goal with the two lessons and the Personal AI Framework assignment was to encourage students to make informed decisions about Gen AI after becoming concerned with how students were using it in previous semesters. We wanted to give them the ability to explain their views on Gen AI instead of prohibiting all uses in the course. We also wanted students to reflect on how their ethical perspectives impact not only their Gen AI use, but their approach to research overall.

The learning representation met two of the course's learning outcomes. With the lessons and assignment, students explored ethical issues in the library and information science field and reflected on how their own ethical perspectives affect their information seeking behavior. They also began to develop, implement, and revise a personalized research process to address an information need by considering how they might use Gen AI to support their research in future course assignments.

Students also engaged with threshold concepts from the ACRL Framework for Information Literacy in Higher Education (Association of College & Research Libraries, 2016) during the class sessions and through the assignment. For example, students grappled with the Authority is Constructed and Contextual frame when students reflected on how Gen AI can present false information as fact and

when they consider the bias that is present in large language models. Students approached the Information Has Value frame when they considered how AI relates to copyright protections and when they discussed some of the "dark sides" of AI, such as the environmental cost of Gen AI systems. Finally, students explored the Information Creation as a Process frame through the Personal AI Framework assignment, where they shared ways in which Gen AI use might help or hinder their research process.

We also learned a lot about the ways current college students think about and use Gen AI in their classes. Across assignments and class discussions, students balanced the ideas of "ethics as personal choices" and "ethics as technology in society" in conversation with one another. Students indicated that they are using Gen AI to assist with generating ideas, summarizing information, and breaking down large tasks. It was interesting to see that there was consensus surrounding unacceptable Gen AI use, which included citing false information in assignments, submitting Gen AI generated work, and not disclosing Gen AI use. This also aligns with the course's policy on Gen AI.

Student responses to the icebreaker question during Lesson 2 highlighted a potential distinction in how students are thinking about the ethical concerns surrounding Gen AI. When presented with two open-ended questions about Gen AI ethics, one third of student responses approached the issue in terms of how individuals use these tools. The rest looked beyond individual use and considered the broader social, legal, and ethical dimensions of these technologies.

One student response in the former category that stood out to Instructor 2 was, "I would like to know if there something specific you would have to put into AI for it to give you false information on a topic." This question of framing (should Gen AI misinformation be addressed as an individual issue or a social issue) went on to shape later in-class discussions about how the process of a technology's development can influence the impact it has once it is deployed.

Three students indicated that they used Gen AI to assist with editing their framework. One student stated that they used ChatGPT to answer the questions outlined in the assignment description. This was concerning because the Personal AI Framework asks students to reflect on their own personal experiences. Another student's assignment

stood out because they argued that any use of Gen AI was unethical because of environmental racism. We did not anticipate this kind of perspective but appreciated the student's justification for their stance.

While implementing the lessons was a success, Instructor 1's perspective about Gen AI changed, particularly around using Gen AI to come up with ideas or brainstorm research topics. Prior to grading the assignment, she supported the use of Gen AI to assist with generating ideas. Gen AI can help one overcome writer's block or view a topic from another perspective, but it can also limit what students can imagine as possible. This became apparent with the research topics for later assignments. The students who used Gen AI throughout the course chose research topics that were similar to one another. Using Gen AI to generate ideas can inhibit unique thoughts and creativity so it is important to equip students with the skills to interrogate the outputs and incorporate their original views.

There are a few ways that this lesson could be adapted to fit different contexts. When we implemented the lesson, we had students from all class years with a variety of majors. If the class had primarily first-years, the two class sessions could be changed to focus more attention on how university policies such as academic integrity or the student code of conduct relate to ethical frameworks and the use of artificial intelligence. Students could also be asked to reflect on how their university's expectations differ from what they experienced in high school. This approach would help newer students gain a better understanding of what rules they are bound by and why. In contrast, for a class of primarily juniors and seniors, the lessons and assignment could prompt students to reflect more on what they believe ethical AI use looks like in their future careers. In a class where most students are from the same major, an instructor could ask more pointed reflection questions and present different examples of AI-related controversies that are connected to their discipline.

The lessons could also be altered to fit time constraints. If an instructor only had a single class session to devote to these topics, they could omit the code of ethics activity in the first lesson and the debate about professors and AI from the second lesson. They could also teach only the ethics lesson or the AI lesson, depending on the needs of the course, although the assignment would need to be

revised to omit content and concepts that students would not be exposed to in class. The lessons could also be run without the accompanying Personal AI Framework assignment. Although that assignment is a great way to encourage thoughtful reflection, students would still benefit from the class activities alone. Alternatively, the assignment could be replaced with a smaller scale in-class journaling exercise.

We do believe that the lessons will help shape future approaches to Gen AI in our class. As students learn about Gen AI, they can connect this learning with their own personal values and can better make informed decisions about what uses of Gen AI they consider to be ethical and appropriate. We plan to make this the first assignment so that students immediately think about Gen AI when the class starts. In addition, we plan to adjust the Personal AI framework assignment description to be specific to Gen AI. Some students reflected on simpler forms of AI such as spell-check or citation management software like Zotero. Although these responses fit the criteria for the assignment, they did not match our original intent. We also want to aim for more discussions about Gen AI throughout the semester and have students refer to their Personal AI Framework periodically so that they can make changes to it as they develop an informed perspective on Gen AI.

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Research & Instruction Librarian for STEM at East Texas A&M University’s Velma K. Waters Library. He holds a Master of Library Science from Texas Woman’s University in Denton, TX and a Bachelor of Science in Theatre from East Texas A&M University in Commerce, TX. Ernest’s research interests include AI literacy education and algorithmic bias. He can be reached at ernestanderson@towson.edu.

Elisabeth B. White is the Head of Library Teaching and Science, Technology, and Mathematics Librarian at the Albert S. Cook Library at Towson University. She has worked at Towson for 7 years. Elisabeth holds a Master of Library and Information Science from St. Catherine University in St. Paul, MN and a Bachelor of Science in Biological Chemistry from Bates College in Lewiston, ME. Elisabeth’s research interests include inclusive pedagogy, digital accessibility, and STEM librarianship. She can be reached at ebwhite@towson.edu.

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ABOUT THE AUTHORS

Jasmine Thomas is a Research & Instruction Librarian at Towson University’s Albert S. Cook Library. She holds a Master of Library and Information Science from the University of Maryland, College Park and a Bachelor of Science in History from Towson. Jasmine serves as the liaison to the English department, providing course integrated information literacy instruction and supporting students and faculty research. She is also an instructor for the library’s credit bearing course LIBR 300: The Information Experience. Her research interests include citation justice and Black feminist librarianship. She can be reached at jlthomas@towson.edu.

Ernest Anderson is a Research & Instruction librarian at the Albert S. Cook Library at Towson University. For the past year, he has served as a liaison to departments within Towson’s Fisher College of Science & Mathematics. Previously, he worked as a

Teaching Students to Identify Ethical Risks and Blind Spots in Academic AI Use

Sara G. McNeil, University of Houston

OVERVIEW

This lesson equips graduate students across disciplines to navigate ethical challenges when using generative AI tools in their research and writing. Through guided discussion, students learn five "AI Personas" (e.g., Research Assistant, Writing Coach, Data Detective, Idea Generator, Academic Concierge) representing common AI use cases. For each persona, students identify specific ethical blind spots and develop mitigation strategies. The technology-rich experience centers on real-time polling, enabling anonymous sharing of concerns and collaborative scenario analysis. Students receive an *AI Ethics Checklist* and an *AI Assistance Log Template*. The assessment includes a pre-/post-poll comparison to demonstrate any changes in ethical reasoning.

Topics: AI ethics, responsible AI use, documentation practices for AI, graduate student use of AI in research and writing

Time: 30 minutes for core content, 45-60 minutes with extended activities.

MATERIALS

- Computer with projector and screen
- Internet connection
- Polling software (Poll Everywhere or similar)
- Student devices
- Whiteboard or flip chart with markers
- [Presentation slides](#)
- [AI Personas Quick Reference Guide](#)
- [Daily AI Ethics Checklist](#)
- [AI Assistance Log Template](#)
- [Scenario Cards for Discussion](#)

CONTEXT-AT-A-GLANCE

Setting

Workshop for doctoral students at a large public research university

Modality

In-person delivery

Class Structure

30-minute session during a monthly doctoral student professional development series

Organizational Norms

The university emphasizes research integrity and innovation and provides professional development support for graduate students. Faculty encourage exploration of emerging technologies while maintaining academic standards.

Learner Characteristics

50-75 doctoral students in education (EdD), diverse backgrounds, varying AI experience from none to daily use.

Instructor Characteristics

Instructor has 20+ years teaching graduate research methods, extensive experience mentoring doctoral students (50+ dissertations), and recent engagement with AI ethics in academic contexts.

Development Rationale

Created to address urgent student questions about AI ethics in academic use amid the absence of clear institutional policies. The training helps students develop judgment-based decision-making frameworks.

Design Framework

Situated learning theory combined with metacognitive reflection strategies, using concrete personas to ground abstract ethical principles in recognizable research contexts.

SETUP

Environment Setup: Arrange seating so that all students can see the projection screen clearly and comfortably. Ensure adequate spacing for note-taking and occasional pair discussions. The room should have controllable lighting (bright enough for device use, dim enough for screen visibility) and minimal audio distractions. Post polling access information (URL and text code) prominently where students can reference it throughout the session.

Technical Setup: Load presentation slides and test all transitions. Log in to the polling platform and load all poll questions (pre-assessment, scenario question, post-assessment) or integrate polling in the presentation. Test poll accessibility from a mobile device to ensure students can connect. Verify internet connectivity is sufficient for simultaneous polling connections. Have a backup plan ready (e.g., Google Form, hand-raising, paper cards) in case of technical failure.

Time Estimate: Allow 15-20 minutes for complete setup. This includes room arrangement (5 minutes), technical testing (10 minutes), and material preparation (5 minutes). Instructors teaching this lesson for the first time should allow an additional 10 minutes to familiarize themselves with the polling platform features and slide presenter notes.

CONTEXT AND SETTING

This lesson was developed and implemented at the University of Houston, a large public research university (R1 institution) serving a diverse metropolitan area. The College of Education houses both EdD (Doctor of Education) and PhD (Doctor of Philosophy) programs, with approximately 150 active doctoral students at any time. The institutional culture emphasizes rigorous scholarship and practical application, reflecting Houston's role as a major urban center with significant educational needs.

When this lesson was developed, the university had not established formal policies on AI use in graduate education. This policy vacuum created anxiety among students who were simultaneously hearing messages that AI was "the future of research" and warnings about academic integrity violations. Faculty were equally uncertain, with some enthusiastically

embracing AI tools while others banned them entirely.

The target audience was doctoral students in education, although the lesson has been adapted for students at other levels and in other disciplines. These students ranged from recent master's graduates in their late 20s to mid-career professionals in their 50s pursuing doctoral degrees while working full-time. Many were practicing educators, administrators, or instructional designers, balancing dissertation work with demanding professional roles.

Most students previously encountered generative AI tools like ChatGPT, Claude, or Gemini, but their experience ranged dramatically. Some had never used AI beyond asking simple questions, while others incorporated AI into their daily research workflow. However, even experienced AI users expressed uncertainty about ethical boundaries. Common questions included: "Can I use AI to summarize articles?" "Is it cheating if AI helps me reorganize my chapter?" "What do I need to tell my advisor?" "How do I cite AI assistance?"

Students' anxiety about AI ethics was compounded by the high-stakes nature of doctoral work. Unlike undergraduate assignments, which can be revised or retaken, dissertation chapters represent years of work and a significant financial investment. The fear of making an irreversible ethical mistake, one that could jeopardize degree completion, created paralysis for some students who avoided AI entirely, even when it might legitimately support their learning.

DELIVERY FORMAT AND CONSTRAINTS

The lesson was designed for the College's "ADVANCE" professional development meeting, which brings doctoral students together for skills training beyond their regular coursework. These sessions are voluntary and compete with students' research, teaching, and work obligations. The time constraint was the most significant design challenge since I wanted to address basic ethical questions in 30 minutes while maintaining engagement and providing practical takeaways for students.

The physical setting was a large classroom with stadium seating, a large projection screen, and reliable Wi-Fi supporting 100+ simultaneous connections. Students brought their own devices

(laptops, tablets, or smartphones) and were comfortable with technology-mediated participation. The informal, supportive atmosphere of the ADVANCE series allowed for honest discussion of challenges and uncertainties without fear of judgment.

INSTRUCTOR POSITIONING

As the instructor, my 20+ years of experience mentoring doctoral students through dissertation completion provided credibility when discussing ethical dilemmas. Students trusted that I understand the pressures they face, the relationships with advisors they must maintain, and the high stakes of their work. However, I also positioned myself as learning alongside them. I shared my own uncertainties about AI ethics and acknowledged that best practices are still emerging. I believe this stance reduced their defensiveness and created space for exploration rather than compliance with prescribed rules.

My moderate (but not expert) technical proficiency with AI tools proved advantageous. Students needed guidance from someone who understood both the technology and the academic context, but not from someone so technically advanced that recommendations felt unattainable. I felt I could model thoughtful AI use without intimidating students who were just beginning to explore these tools.

DESIGN DECISIONS

The design framework combined situated learning theory, which grounds learning in authentic contexts and real problems, with metacognitive reflection strategies that prompt learners to monitor and evaluate their own thinking and decision-making. Together, this framework structured students' thinking through concrete personas while incorporating deliberate pauses for self-assessment.

That framework guided my decisions as I developed the lesson. Five key decisions reflect how I translated situated learning and metacognitive reflection into a practical and engaging session for doctoral students.

PERSONAS FRAMEWORK

Rather than abstract ethical principles, I developed five "AI personas" that represent specific use cases students would encounter in their research. This helped to address the disconnect between theory and practice. Students could immediately identify which persona matched their situation and use the blind spots and practical responses to think through their own AI use.

INTERACTIVE POLLING

Opening with a poll allowed students to share their concerns anonymously and see that their peers held a wide range of perspectives. The real-time display created a sense of community around what might otherwise have felt like an isolating uncertainty. Doctoral students often assume everyone else has figured out the rules while they are still struggling with the boundaries. Seeing responses range from genuine anxiety to enthusiastic embrace helped normalize the conversation before it began. This sense of community and the anonymity of the responses provided psychological safety for students to engage openly and honestly throughout the session.

JUDGMENT OVER RULES

I designed this lesson to cultivate judgment rather than provide rules, since students needed frameworks that would work regardless of specific context or evolving AI capabilities. The four "red flag questions" reflect that approach:

- If my advisor asked me to explain this right now, could I?
- Would I be comfortable defending this choice in my defense?
- Am I using AI to learn faster or to avoid learning?
- Could someone reproduce my work based on my documentation?

These questions functioned as metacognitive prompts: they required students to step back from task completion to assess their own understanding, honesty, and process.

DOCUMENTATION EMPHASIS

I emphasized documentation because it works across disciplines and advisor expectations. In the absence of clear institutional policies, students needed a personal record of their AI use that could withstand scrutiny from their advisor or committee.

The AI Assistance Log template provides that structure, making documentation feel manageable rather than burdensome, making their processes transparent to advisors, and building habits of accountability. The log also serves as a metacognitive tool, prompting students to reflect on their purpose, process, and learning each time they use AI.

PRACTICAL TAKEAWAYS

I developed the Daily AI Ethics Checklist and documentation template to provide students with immediately usable tools that justify their time investment in attending. The Checklist extends the reflective practice from the session into students' ongoing work, prompting them to evaluate purpose, attribution, understanding, and growth each time they use AI.

Together, these five decisions reflect the situated learning framework's emphasis on authentic, contextually grounded practice, using real student concerns and realistic scenarios to make abstract ethical principles concrete. The metacognitive reflection strategies are built into each phase: The opening poll reveals students' existing assumptions, the red flag questions interrupt task-focused thinking and prompt self-assessment, and the Daily AI Ethics Checklist sustains that reflective practice beyond the session itself.

LEARNING REPRESENTATION

PHASE 1: INTRODUCTION (3-4 MINUTES)

Learning Objective: Students will explore their existing concerns about AI use and establish a baseline understanding of ethical considerations.

ACTIVITY: OPENING POLL

I opened the session using Poll Everywhere (<https://www.polleverywhere.com/>), displaying the polling slide with a web URL and text message access option to accommodate different devices. This tool worked well for this purpose, though the free version limited responses to 40 per session.

I asked students: *In a few words, describe your biggest concern about using AI in your doctoral work.*

As responses accumulated over one to two minutes, I commented on them in real time, noting emerging themes aloud to build engagement and signal that their concerns were heard. After collecting responses, I identified two or three common themes using students' language and explicitly connected them to the session ahead. I could have captured the themes on a whiteboard for visual reference during the Phase 3 content presentation.

The response patterns served as a baseline indicator of students' sophistication with AI ethics. Surface-level concerns ("getting in trouble") suggested a need for foundational framework-building, while metacognitive concerns ("losing my voice") indicated students were already thinking about AI's impact on their scholarly development. I used this read to shape my emphasis during the personas discussion that followed.

TRANSITION

I closed the opening by asking students to keep their concerns in mind throughout the session, and I framed the personas framework ahead of time as a tool for answering many of those questions for themselves.

PHASE 2: FRAMING THE CHALLENGE (1-2 MINUTES)

Learning Objective: Students will establish a pragmatic, non-judgmental stance toward AI use and clarify the session focus.

CONTENT PRESENTATION

I displayed a slide with news headlines that presented conflicting narratives: AI as an existential

threat and AI as a transformative opportunity. A "Reality Check" slide followed, anchoring the session's central message that AI is not going away, and the relevant question is not whether to use AI in doctoral work but how to use it ethically and effectively.

Then I displayed the learning objective, framing the session explicitly as being about developing judgment rather than following rules, neither avoiding AI nor embracing it uncritically. This framing proved important for reducing defensiveness and creating space for honest engagement with the personas that followed.

PHASE 3: CORE CONTENT - THE FIVE AI PERSONAS (15-18 MINUTES)

Learning Objective: Students identify specific use cases, ethical risks, and mitigation strategies for five common AI applications in research.

INSTRUCTIONAL STRUCTURE

For each persona, I followed a consistent three-minute pattern: briefly describing what the AI tool does in that role, acknowledging why it is genuinely tempting for doctoral students, identifying the ethical blind spots students most commonly miss, and suggesting practical ways to address those risks. This predictable structure helped students take effective notes and compare across personas as we moved through them.

PERSONA 1: THE RESEARCH ASSISTANT (3 MINUTES)

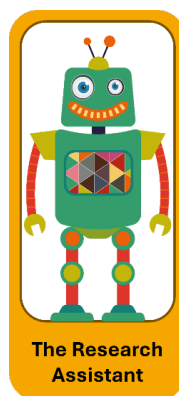


Figure 1. The Research Assistant.

I introduced the Research Assistant persona (see Figure 1) as the one most students had already encountered. Artificial intelligence is used to summarize articles, identify themes across literature, suggest search terms, and make an overwhelming body of literature feel manageable. When I asked for a show of hands on who had already used AI for these purposes, most students responded affirmatively. This helped normalize the conversation.

The temptation with this persona is worth acknowledging: What used to take weeks to complete can feel like it takes hours with AI. But I focused on three blind spots that users may miss if they use AI to summarize multiple sources:

The first is what I called the Synthesis Trap, consuming AI's interpretation of the field rather than personally wrestling with the ideas. Students might summarize sources fluently but struggle when others push them to engage in genuine scholarly debate.

The second is citation integrity: when AI synthesizes fifty papers, it can be unclear whose ideas are being built upon and whether crucial methodological details were considered.

The third is the knowledge gaps and biases that result. AI systems reflect biases in their training data, which means students risk framing their research around those biases rather than interrogating them. A study's 30% response rate or convenience sample may not be included in an AI summary, and entire perspectives or bodies of scholarship may be underrepresented or missing entirely. Reading against AI-generated themes rather than simply seeking confirmation is an important check.

I offered students four practical suggestions:

1. Treat AI summaries as starting points rather than endpoints,
2. Always go back to original sources before citing them,
3. Test your own understanding by asking whether you could explain the concept to your advisor without the summary, and
4. Document your process so your reasoning is transparent, including any steps you took to identify and check against potential AI bias in the themes that emerged.

PERSONA 2: THE WRITING COACH (3 MINUTES)

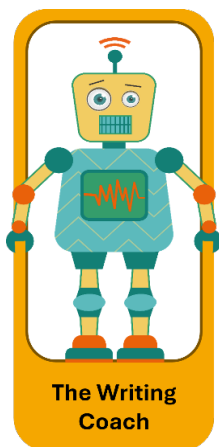


Figure 2. The Writing Coach.

The Writing Coach (see Figure 2) is the AI persona that improves sentence structure, suggests transitions, helps with academic tone, and breaks through writer's block at 2 a.m. Students connected with this persona immediately. The temptation is obvious: AI fixes awkward phrases instantly and writing sounds more polished and academic. But I focused on three blind spots that are easy to miss.

The first is voice authenticity. If AI reorganizes your arguments, improves your word choice, and creates your transitions, at what point does it become AI's writing rather than your own?

The second is intellectual honesty. There is a difference between learning to write academically and learning to prompt AI to write for you. Your advisor expects to see your thinking process, including the messy parts, because that is how they know where you are struggling and how you are developing.

The third is committee expectations. Your committee is not just evaluating your conclusions; they are evaluating how you think. When they read only perfect, polished prose, they lose visibility into your reasoning process, and you lose the feedback that helps you develop as a scholar. Sometimes a messier draft reveals more about your thinking than AI's cleaned-up version.

I offered four practical suggestions:

1. Use AI for mechanics like grammar and transitions,
2. Save pre-AI versions and ask yourself whether you can still recognize your own thinking,
3. Be transparent with your advisor about what assistance you are using
4. Keep an AI assistance log. The log is more than a record because it prompts the kind of metacognitive reflection the red flag questions are designed to encourage. Before accepting AI's changes, students should be able to answer: Could I explain this reorganization to my advisor right now? Would I feel comfortable defending it in my defense? Those questions turn the Writing Coach from a shortcut into a learning tool.

PERSONA 3: THE DATA DETECTIVE (3 MINUTES)

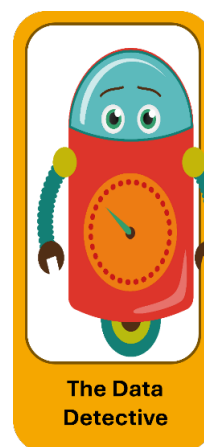


Figure 3. The Data Detective.

The Data Detective persona (see Figure 3) suggests statistical approaches, identifies patterns in datasets, explains complex analyses, generates analysis code, and catches errors. I noted that this persona is particularly relevant for quantitative work, but increasingly valuable for qualitative methods as well. I focused on three blind spots.

The first is what I called the Black Box Problem. If AI suggests an analytical approach and you cannot explain why you chose it, you may be in trouble when your committee asks you methodological questions regarding your work. "Because AI suggested it" is not a defense!

The second is methodological rigor. AI tends to suggest approaches that are good enough rather

than most appropriate for your theoretical framework and your discipline's standards. It does not know your field the way your methodologist does.

The third is reproducibility. If your analysis depends on AI-generated code that you do not fully understand, it may be difficult for others to replicate your work, and replicability is a cornerstone of research integrity.

I offered four practical suggestions:

1. Never use a method you cannot explain,
2. Verify AI suggestions against disciplinary best practices and your committee's guidance,
3. Document your prompts and AI's reasoning alongside your own verification steps,
4. Test yourself by asking whether you can explain why the method is appropriate, interpret the results, and defend the choice.

The goal is for AI to introduce you to methods you then make your own through study and consultation, not for AI to make methodological decisions for you. There is a meaningful difference between saying "AI told me to use this approach" and saying "AI introduced me to this method, I studied it, consulted with my advisor, and chose this approach because it fits my theoretical framework and research questions." A developing scholar should work by using available tools to accelerate learning while maintaining ownership of every methodological decision.

PERSONA 4: THE IDEA GENERATOR (3 MINUTES)

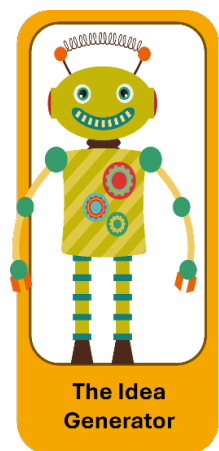


Figure 4. The Idea Generator.

The Idea Generator persona (see Figure 4) brainstorms research questions, suggests theoretical frameworks, proposes novel connections, and breaks through creative blocks. I described this persona as a brainstorming partner who is available at 2 a.m., can offer perspectives from outside your field, and can generate dozens of options quickly. That availability is genuinely appealing to doctoral students who often feel isolated in their thinking. I then focused on three potential blind spots.

The first is originality. When you brainstorm with a human colleague, ideas emerge from genuine intellectual exchange. AI brainstorming works differently because AI tools cannot contribute original thought the way a human collaborator can. If AI tools suggest a theoretical framework and you develop it extensively, questions about whose insight it represents become complicated.

The second is feasibility. AI tools do not know your actual resources, timeline, or committee's expectations. They may suggest ideas that are completely impractical for a doctoral dissertation (e.g., a five-year longitudinal study, access to populations you cannot reach, methods requiring expertise you do not have time to develop).

The third is research currency. AI's training data does not know your subfield's literature the way active scholars do. An idea that seems novel may have already been explored, contested, or abandoned for reasons that only emerge through deep engagement with current scholarship. Before investing time in an AI-suggested direction, complete a thorough literature search. I offered four practical suggestions:

1. Treat AI-generated ideas as raw material that requires your disciplinary expertise and critical analysis,
2. Reality-test ideas with your advisor and peers who know your actual constraints,
3. Conduct thorough literature searches before committing to an idea,
4. Document the origin of ideas clearly so you can articulate your own intellectual contribution.

PERSONA 5: THE ACADEMIC CONCIERGE (2-3 MINUTES)

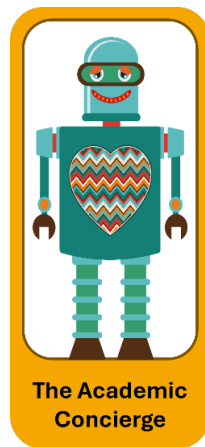


Figure 5. The Academic Concierge.

I introduced the Academic Concierge persona (see Figure 5) as the most straightforward persona and noted that it could be abbreviated if time was running short. This persona uses AI as an administrative assistant: formatting citations, checking grammar and style, managing administrative writing, and handling tedious tasks that consume mental energy. I focused on three blind spots.

The first is skills atrophy. Academic competencies such as citation formatting and style conventions are skills you may need independently throughout your career (in contexts where AI tools are not available or appropriate). Faculty positions, editorial roles, and professional writing all assume a baseline mastery of these skills. Gaps may become visible at bad moments.

The second is quality control. AI tools make mistakes, specifically with citations: AI tools may invent digital object identifiers (DOIs), get dates wrong, and misattribute authors. I shared a concrete example here: A student whose dissertation contained a single fabricated citation generated by AI. That single error delayed the defense by three months while every citation was verified.

The third is professional development. Learning to cite different sources and to follow academic conventions, such as APA, is part of doctoral training. Understanding why citations work the way they do makes individuals more careful and credible scholars. It also builds the kind of attention to detail that carries over into every aspect of research, from

data management to peer review. I offered four practical suggestions:

1. Maintain competency by doing some tasks manually on a regular basis,
2. Always verify citations against original sources,
3. Follow what I called a 70/30 rule where you handle the majority of routine tasks yourself
4. Use AI tools selectively, and redirect the time AI tools saves you toward higher-level skill development—rather than just efficiency.

PHASE 4: APPLICATION AND INTEGRATION (8-10 MINUTES)

Learning Objective: Students apply the personas framework to realistic scenarios and receive practical decision-making tools.

ACTIVITY 1: UNIVERSAL RED FLAGS (2 MINUTES)

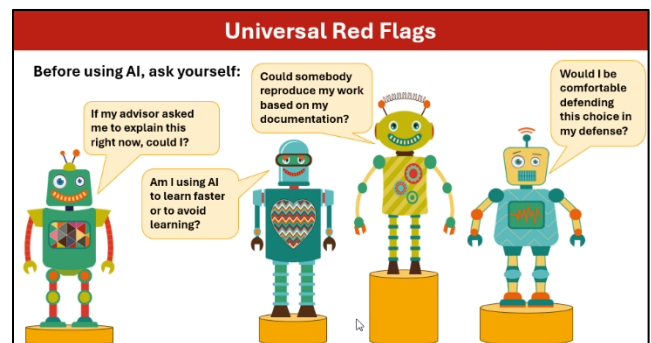


Figure 6. Four universal red flags.

I transitioned to a set of four questions I called universal red flags, displayed on a slide showing each of the five persona robots posing a question (see Figure 6). I framed these as applying to any AI use, regardless of which persona is involved.

The first question is: If my advisor asked me to explain this right now, could I? Not tomorrow after you study, but right now. If the answer is “no,” that is a signal to stop using AI and start learning.

The second is: Would I be comfortable defending this choice in my defense? I encouraged students to sit with their emotional response to that question, because discomfort is itself useful information.

The third is: Am I using AI to learn faster or to avoid learning? I told students this is the most important question of the four because one path develops you as a scholar, while the other quietly undermines you. It requires honesty with yourself.

The fourth is: Could someone reproduce my work based on my documentation? If your process depends on AI interactions you have not recorded, your work is not reproducible, which is a fundamental problem regardless of discipline. I framed these four questions as an ethical compass rather than a checklist, something to return to before any AI interaction, not after the fact.

ACTIVITY 2: INTERACTIVE SCENARIO ANALYSIS (3-4 MINUTES)

I presented a scenario through the polling platform to give students a chance to apply the framework to a realistic situation. The scenario was:

Maria uses AI to restructure her literature review chapter. The AI reorganizes her arguments, improves transitions, and fixes awkward sentences. The ideas and evidence are still hers. Does Maria need to acknowledge this AI assistance, and if so, how?

Student responses fell into predictable patterns: some said yes, in a footnote; some said no, because it was just editing; others said to tell the advisor but not document it in the dissertation itself. Rather than immediately providing an answer, I used a think-aloud to model how to apply the framework.

Which persona is Maria using? The Writing Coach.

What are the blind spots? Voice authenticity and intellectual honesty.

Applying the red flag questions:

Could Maria explain the reorganized arguments to her advisor? Probably yes, since the ideas are hers. But did the reorganization reveal a logical structure she was not seeing herself? That is where it gets complicated.

I was direct with students that there is no universal right answer to Maria's situation. It depends on her program's policies, her advisor's expectations, and crucially, what she learned from the process. If AI helped her see weaknesses in her organization that she then understood and could explain, that is

learning. If she accepted the changes without understanding why the new structure worked better, that is a problem.

For documentation, I suggested that Maria record the assistance in her process notes and inform her advisor, even if it does not appear in the dissertation itself. The point of the scenario was not to resolve it definitively but to demonstrate that the framework gives students a principled way to think it through, and that developing that habit of reasoning matters more than arriving at any single right answer.

ACTIVITY 3: DAILY AI ETHICS CHECKLIST (2 MINUTES)

Your Daily AI Ethics Checklist

Before using AI:

- ✓

Purpose

What exactly am I asking AI to do?
- ✓

Attribution

How will I acknowledge this assistance?
- ✓

Understanding

Will I still understand my own work?
- ✓

Growth

Am I learning or just getting things done?

Figure 7. The daily AI ethics checklist.

I distributed the Daily AI Ethics Checklist (see Figure 7), either printed or as a digital download, and walked students through its four prompts. I asked students to be specific about purpose before using AI, thinking not just "help with literature review" but "summarize three articles to identify themes I will look for when I read them fully." I asked them to think through attribution before they begin, not after they used AI. I asked them to consider whether they would still understand their own work after AI assistance. I also asked them to reflect honestly on whether they were learning or just getting things done.

ACTIVITY 4: KEY TAKEAWAYS (2 MINUTES)

I closed the application phase by presenting four takeaways on a slide. Each AI persona has specific

benefits and blind spots, so there is no universal answer about whether AI is good or bad in doctoral work.

The biggest risks are losing understanding, authenticity, and professional development. Ethical AI use is possible but requires intentionality and documentation. Finally, the goal is for AI to enhance your thinking, not replace it.

I gave students thirty seconds to reflect on which takeaway resonated most and which one would be hardest to apply in their current work.

PHASE 5: CLOSING AND NEXT STEPS (2-3 MINUTES)

Learning Objective: Students leave with concrete action steps and a clear path for continuing to develop ethical AI practices.

I closed the session by displaying four action steps on a slide.

I asked students to keep the Daily AI Ethics Checklist somewhere visible, not filed away. I encouraged them to start an AI assistance log immediately, even if their program does not require one, framing it as a two-minute per-entry task that will save hours of uncertainty later. I shared a QR code linking directly to the log template so students could access it before leaving the room.

I asked them to have an explicit conversation with their advisor about AI policies and suggested they ask directly about what assistance is appropriate, how it should be documented, and what their advisor would want to know.

I also encouraged them to continue talking with their peers about their practices, because the ethical questions doctoral students face around AI are best worked out in a community rather than in isolation.

OPTIONAL: FINAL POLL (1 MINUTE)

I added a closing poll asking students which persona they were most likely to try responsibly in the next month, with the option to select “none” and indicate they needed more time to think it over. The results gave a natural way to close with energy, reflecting to students what they were taking away and signaling

that trying one persona thoughtfully was a reasonable next step.

CLOSING MESSAGE

I ended with the same message: The goal is responsible use, not perfect use (see Figure 8). Students will make mistakes and encounter gray areas that these personas do not fully resolve. The framework is a beginning, not an ending, and a foundation for ongoing ethical practice throughout their doctoral journey and beyond.

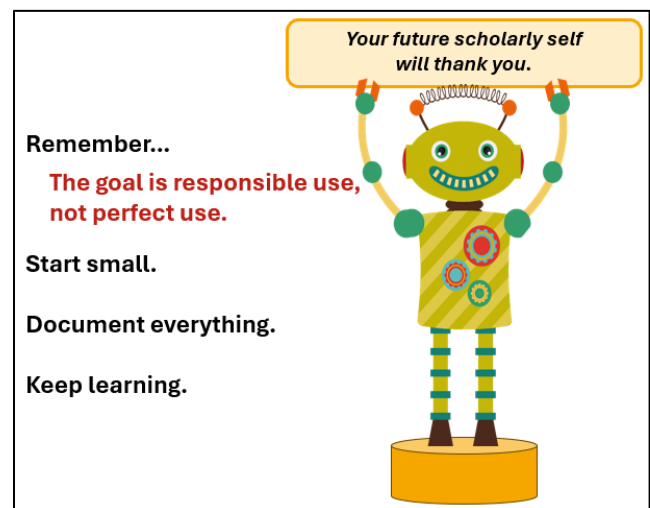


Figure 8. The goal is responsible use, not perfect use.

I stayed after the session to continue conversations and gave students my contact information for questions that came up later.

EXTENDED VERSION (15-30 MINUTES)

If there is additional time, instructors can use the six Scenario Cards for deeper practice with the personas framework. Each card presents a realistic situation involving one or more of the five personas and gives students a chance to work through ethical decisions using the red flag questions as a guide.

In Activity 2 of the core content session, the instructor uses a single scenario to model the application of the framework. In the extended version, small groups could each receive a different scenario card and work through the analysis together before sharing with the full group. This format would add approximately 15-30 minutes to the total

session, depending on the number of scenarios used and the depth of discussion. The small group structure would also address one of the limitations of the core session: Students would benefit from debating interpretations with peers rather than simply observing the instructor model the process. This extended format has not yet been implemented but was developed in response to students consistently requesting more time for scenario practice.

TOTAL TIME: 30 MINUTES

- Phase 1: 3-4 minutes
- Phase 2: 1-2 minutes
- Phase 3: 15-18 minutes
- Phase 4: 8-10 minutes
- Phase 5: 2-3 minutes

FLEXIBILITY

If running behind, the instructor could abbreviate Academic Concierge (Phase 3) and shorten scenario discussion (Phase 4). Instructors should preserve the final 5 minutes for checklist distribution and closing.

ASSESSMENT

PRE-ASSESSMENT (FORMATIVE)

The opening poll served as the primary pre-assessment, revealing students' baseline understanding of AI ethics. I analyzed response patterns in real time, focusing on which types of concerns came up most often. For example, from one implementation, surface-level concerns included "The thought of using AI gives me anxiety for fear of getting kicked out of the program" and "Having the dissertation and degree taken away many years after graduating." Practical concerns included "I don't know how much is too much" and "I am concerned about my work being marked as completed by AI even when I use AI just for editing my writing." Metacognitive concerns included "At what point does the editing and revisions stop becoming my own work/thoughts?" and "Allowing it to sway my own thinking." Those responses shaped how I framed the personas discussion in that session.

Paying attention to the mix of concern types early can help instructors shape their emphasis during the personas discussion. A group where surface-level concerns come up most often may benefit from more foundational framework-building, while one where metacognitive concerns are more prevalent can move more quickly into deeper engagement during the scenario analysis.

DURING-LESSON ASSESSMENT (FORMATIVE)

During the session, I used hand-raising questions to reveal personal experience levels and create low-stakes opportunities for students to acknowledge their AI use without defensiveness.

The scenario poll responses were the most informative mid-session indicator and revealed whether students could apply the personas framework to a realistic situation rather than just recall its components. Responses that identified a specific persona, articulated a blind spot, and proposed a documentation strategy showed genuine application of the framework rather than just surface familiarity.

POST-ASSESSMENT (SUMMATIVE)

The primary summative indicator was a comparison of pre-session poll responses with the questions and comments students raised at the end of the session. Evidence of learning showed up in several ways: Students shifted from vague concerns to specific language tied to particular personas, they referenced the framework vocabulary naturally in follow-up questions, and they asked practical implementation questions rather than conceptual ones. This shift from broad anxiety to specific, actionable thinking suggested that even a 30-minute session could move students toward more sophisticated ethical reasoning about their AI use.

USING THIS LESSON IN CREDIT COURSES

In credit-bearing courses, instructors could use a graded documentation practice assignment to support the development of ethical AI practices. Students could complete one substantive research task using AI assistance, such as a literature review,

writing improvement, or statistical analysis; document the process using the AI Assistance Log Template; and write a reflection addressing persona application, ethical blind spots, and the four red flag questions. The assignment could be assessed using seven criteria:

1. Log completeness,
2. Prompt specificity,
3. Verification evidence,
4. Critical use of AI output,
5. Persona application,
6. Red flag awareness,
7. Reflection depth.

This assignment could be particularly effective when students submit entries at multiple points during a semester, allowing instructors to support students as they develop their documentation practices.

CRITICAL REFLECTION

The primary learning objective was consistently met in my implementation with approximately 75 doctoral students at the University of Houston's College of Education ADVANCE professional development conference. Pre- and post-poll comparisons showed students shifting from vague concerns like "Is it cheating?" to sharing specific blind spots such as "voice authenticity when using the Writing Coach."

The personas framework proved more durable than I expected. Students continued using the vocabulary weeks later without formal reinforcement. I believe this was partly due to the robots' fun and quirky representations, which made each persona appealing and memorable. Interactive polling created immediate engagement and a sense of community, and anonymity encouraged honesty about AI use that students might otherwise have been reluctant to share. The Daily AI Ethics Checklist proved useful: simple, portable, and immediately usable. Two faculty colleagues subsequently adapted the materials for courses they taught, both using the provided slides, which include a script in the presenter notes.

Psychological safety mattered more than I anticipated. The opening poll revealed the full range of student perspectives. Some responses reflected genuine fear: "The thought of using AI gives me anxiety for fear of getting kicked out of the program,"

and "Having the dissertation and degree taken away many years after graduating." Others reflected practical uncertainty: "I don't know how much is too much," and "At what point does the editing and revisions stop becoming my own work/thoughts?" A few expressed no concern at all: "Absolutely no concerns. I am beyond excited to use AI." The breadth of that range in a single room made it clear that a one-size-fits-all approach would not work. I found that opening with explicit reassurance that the session was about going forward thoughtfully, rather than catching anyone, was essential for engagement across that range. The non-judgmental tone throughout created the conditions for that honesty, and I believe it was what allowed students to participate openly rather than defensively.

I could also have made stronger use of the opening poll by writing the top concerns on a whiteboard and explicitly addressing each one as I moved through the personas. This strategy would have strengthened the connections between the pre-assessment and the core content. The 30-minute constraint created tension between depth and breadth that I couldn't fully resolve. Five personas in 15 minutes meant three minutes each, which was enough to introduce the framework but not enough for students to practice applying it. One scenario was insufficient; students needed multiple practice opportunities, ideally in small groups where they could debate interpretations together.

The absence of systematic follow-up was a missed opportunity. While anecdotal evidence suggests lasting impact, I cannot confidently assess whether students changed their documentation practices or had the advisor conversations that I encouraged. The lesson also addressed individual ethics but did not sufficiently address the systemic challenges students face: conflicting advisor expectations, absent institutional policies, and evolving norms.

There are a few additions I would make in future implementations. An extended scenario library covering qualitative analysis, survey design, theoretical frameworks, grant writing, and IRB applications would give students more practice opportunities. Discipline-specific slide decks for STEM, humanities, and social sciences could be more relevant in other contexts. A brief guide for advisors, summarizing the framework and suggesting conversation prompts, would support the student-advisor conversations I encouraged. A brief follow-up at two weeks and at one month could help

assess whether students changed their practices in ways that a single session cannot capture.

CONCLUSION

This lesson successfully introduced graduate students to ethical frameworks for AI use, meeting its primary objective of building awareness. The personas framework proved intuitive and memorable. The lesson functions best as a catalyst for ethical thinking rather than a comprehensive solution, and it is particularly effective when followed by opportunities for practice and feedback. As AI capabilities evolve, specific examples and scenarios will need updating, but the red flag questions, the personas framework, and the emphasis on documentation remain relevant because they focus on scholarly development rather than on any particular tool or policy.

That relevance did not happen by accident. The five design decisions were central to translating situated learning and metacognitive reflection into a structure students could remember and use on their own.

1. Personas Framework
2. Interactive Polling
3. Judgment Over Rules
4. Documentation Emphasis
5. Practical Takeaways

Grounding the lesson in situated learning theory meant that ethical principles were not presented in the abstract but through recognizable use cases that students encountered in their own work. The metacognitive reflection strategies built into each phase gave students tools for ongoing self-assessment rather than a one-time set of rules. Together, these decisions translated theory into a structure that students could understand, remember, and use independently long after the session ended.

AI is not inherently good or bad, ethical or unethical. It is a powerful, flawed, and evolving tool. Like any tool, its ethical status depends on how we use it and toward what ends. This lesson equips students to make those determinations thoughtfully and in ways that support their development as scholars. The goal is not perfection. Students will make mistakes, encounter gray areas that these frameworks do not fully resolve, and face situations that require

judgment beyond the scope of any lesson. That is expected and appropriate.

This lesson aims to develop students who recognize the ethical dimensions of AI use, think carefully before acting, document their practices transparently, prioritize learning over efficiency, and contribute authentically to their fields. The goal of this lesson is to support students in becoming intentional, thoughtful practitioners and scholars who can ask the right questions about their AI use, document their decisions, and develop the habits of mind that will serve them throughout their careers.

ACKNOWLEDGEMENTS

The author used Claude (Anthropic) during the initial development of this lesson to brainstorm innovative ways to present AI ethics in a format that felt approachable and engaging rather than rule-based or punitive. Claude suggested several ideas that the author evaluated, developed, and shaped into the personas framework, lesson structure, and assessment that appear in this manuscript.

Claude was also used during manuscript revision to improve readability, restructure content, and refine language in response to reviewer feedback. Claude proposed revisions that the author evaluated, refined, and incorporated at her discretion.

All instructional design decisions, implementation experience, and reflections are the author's own, as are the presentation slides and all visual and design elements in the supplemental materials, none of which were AI-generated. AI assistance was limited to brainstorming and editing of author-originated content, consistent with the JTILT AI use policy.

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ABOUT THE AUTHOR

Sara McNeil, Ed.D., is an Associate Professor in the Learning, Design, and Technology program at the University of Houston College of Education. Her background spans instructional design, educational graphics, and online learning, work that has shaped her current research and teaching on the responsible and ethical integration of generative AI in higher education. She focuses particular attention on how graduate students develop critical judgment about AI tools in research and academic writing. One of her current studies examines AI literacy not as a standalone subject but as an integrative framework, positioning future educational leaders to ask, across every tool and every decision:

“What can AI contribute here, and what is yours to decide?”

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Using AI-Generated Multimedia to Teach Leisure Choice-Making

Charles Thull, Old Dominion University

OVERVIEW

This learning representation introduces an AI-developed, multimedia assessment for identifying leisure preferences among middle school students with developmental disabilities. Grounded in instructional design, ecological systems, and multimedia learning theories, the activity integrates ChatGPT, InVideo AI, Sora, DALL-E, and Gemini to create guided-choice visuals, short videos, and a structured, teacher-facilitated paired-choice activity using visual prompts across home, school, and community interest contexts. The technology-developed design fosters engagement, accessibility, and self-expression as students participate in a structured, teacher-facilitated paired-choice activity. Outcomes include enhanced student voice in leisure planning, increased self-awareness, and the identification of potential leisure interests. Assessments include student responses to paired leisure activities that represent interests across multiple environments.

Topics: Leisure interests, students with disabilities, special education, preference assessment, artificial intelligence.

Time: Four learning sessions, each 20 minutes.

MATERIALS

- Student Record Form
- Writing tools for each student
- Leisure Preference Assessment Slides ([School](#), [Home](#), [Outside](#), and [Community](#))
- Printed copies of the [Leisure Preference Assessment](#)
- Computer to run the PowerPoint, projector or classroom display, and speakers.

CONTEXT-AT-A-GLANCE

Setting

Large, suburban, United States, public-school district serving middle school students with disabilities.

Modality

In-person with slides and paper-based materials for structured choice assessment.

Class Structure

Implemented in four 20-minute lessons to small groups with flexible pacing.

Organizational Norms

The district prioritizes inclusive transition planning and technology-supported instruction, providing access to devices, software, and professional learning.

Learner Characteristics

Designed for middle school students with autism spectrum disorder (ASD) and developmental disabilities who benefit from visual supports, predictable routines, structured choices, and scaffolded communication. Supports diverse responses, including pointing, gestures, AAC, simplified language, and repetition.

Instructor Characteristics

A special education teacher who develops transition curriculum and assessments and provides direct instruction using multimedia tools and AI-supported design practices.

Development Rationale

Created to increase accessibility, engagement, choice-making, and student voice in leisure preference assessment.

Design Framework

Grounded in instructional design, ecological systems theory, multimedia learning, and rapid prototyping.

SETUP

The instructor connects a computer to a projector or display with speakers, opens the Google Slides or PowerPoint version of the assessment, and distributes printed response sheets to students. Setup typically requires 5–10 minutes to connect equipment, test audio, and arrange paper materials. Instruction may be delivered one-on-one or in small-group settings.

STANDARDS

This learning representation aligns with the Council for Exceptional Children (CEC) *Advanced Preparation Standards* in Transition and Collaboration, emphasizing evidence-based practices that promote self-determination, student voice, and individualized planning for learners with disabilities (Council for Exceptional Children [CEC], 2022). It also aligns with the Association for Educational Communications and Technology (AECT) Standards for Professional Education, specifically *Standard 1 (Content Knowledge)* and *Standard 3 (Learning Environments)*, through the integration of instructional design, multimedia learning theory, and equitable technology use to enhance accessibility and engagement (AECT, 2020).

CONTEXT AND SETTING

This multimedia leisure preference assessment was designed by the author, a special education teacher and instructional designer in a large suburban U.S. public-school district that emphasizes inclusive transition and career education. The district serves diverse middle school learners with ASD and related developmental disabilities who experience challenges communicating interests through traditional written or verbal formats. These needs informed the design's emphasis on visual, multimodal representation and predictable instructional structure.

The leisure assessment described in this article was implemented by the author in a face-to-face classroom setting with eight seventh- and eighth-grade students enrolled in a specialized instructional program and identified with ASD and/or Intellectual Disability (ID). All students were verbal; however,

expressive language abilities varied considerably across the group, particularly in pragmatic communication, conversational reciprocity, and social understanding. Cognitive abilities also spanned a wide range, reflecting the heterogeneity commonly observed in individuals with ASD (Litman et al., 2025), and ASD-related support needs were generally moderate, especially in the areas of social communication, self-regulation, and sustained engagement during structured learning tasks.

In everyday classroom instruction, several students communicated most comfortably through brief phrases, gestures, or visual attention, while others were able to speak in longer sentences but still required clear structure and prompting to express preferences or make decisions. Across learners, common characteristics included restricted or highly preferred interests, limited spontaneous peer engagement, difficulty interpreting or responding to nonverbal social cues, and challenges with reciprocal social interaction. Some students actively sought interaction but demonstrated difficulty adjusting language, behavior, or personal boundaries to match social contexts, while others preferred solitary engagement and required adult prompting to participate.

Instructionally, students frequently benefited from visual modeling, predictable routines, reduced language demands, and structured response formats to support comprehension and participation. Opportunities to respond using multiple modalities—such as pointing, looking, touching, circling, or speaking—were particularly important for enabling expression of preferences. These learning characteristics underscored the need for instructional tools that provide multimodal access to content—including short videos, animated visuals, and structured text-and-image choice options—alongside flexible response pathways that allow students to demonstrate understanding without relying solely on complex verbal explanation.

The design was guided by ecological systems theory (Bronfenbrenner, 1994) to represent leisure interests across home, school, and community contexts, and by multimedia learning theory (Mayer, 2009) to align visuals, narration, and text for clarity and engagement. Instructional design and rapid-prototyping approaches (Tripp & Bichelmeyer, 1990) further supported efficient development and practical classroom usability. Design decisions prioritized accessibility, efficiency, and real-world feasibility. AI-

supported development tools (e.g., ChatGPT, DALL·E, InVideo AI, Sora, and Gemini) enabled rapid prototyping, visual customization, and scalable revision while maintaining alignment with multimedia learning and instructional design principles.

To support accessible participation, the assessment intentionally reduced language demands, supported multiple modes of expression, and allowed individualized pacing within a shared instructional routine. Structured “fields of two” visual choices sought to minimize cognitive load and enabled students to demonstrate preferences without requiring complex expressive language, increasing accessibility for learners with ASD and ID.

Assessment materials were later posted within the district’s Learning Management System (LMS) to support educator access. However, implementation described in this article reflects the author’s direct classroom use of the multimedia leisure preference activity rather than districtwide adoption.

LEARNING REPRESENTATION

INTRODUCTION

The AI-powered multimedia leisure preference assessment was designed to help middle school students with ASD communicate their leisure interests across four ecological settings: home, school, outside, and community. The tool integrates short videos, animated GIFs, and images to make abstract leisure concepts more concrete, supporting students who experience challenges with expressive language, attention, understanding of abstract ideas, and making choices.

LEARNING OBJECTIVES

Students will:

- communicate leisure preferences using structured visual choices.
- identify interests across home, outdoor, community, and school settings.
- respond using pointing, gestures, or verbal expression.

During each session, students engage in a structured choice-making routine using paired visual options. With teacher support, students indicate preferences and gain repeated opportunities to practice selecting and communicating choices across settings.

CONTENT DEVELOPMENT PROCESS

The instructional activity follows a structured sequence in which students view paired choices, select a preferred option, and communicate responses with teacher support. The following sections describe how AI tools were used to develop the multimedia materials supporting this process.

The assessment was developed using a rapid instructional design prototyping process that employed four generative AI tools: ChatGPT, InVideo AI, Sora, DALL·E, and Gemini. Each platform contributed to a specific stage of content creation, resulting in a cohesive, multimedia learning representation that could be replicated and adapted by teachers.

All figures in this manuscript are screenshots documenting the design and implementation process. This includes screenshots of tables generated in Google Docs (Figures 1–4), screenshots of the actual design interface and workflow within InVideo AI and Sora (Figures 5–7), and screenshots of the final assessment materials featuring DALL·E- and Gemini generated images as they appear embedded in the Google Slides deck (Figures 8–11).

1. CHATGPT – QUESTION AND STRUCTURE GENERATION

ChatGPT was used to generate paired-choice activity prompts representing common middle school leisure activities across four ecological settings: home, outdoors, community, and school. Leisure items were presented using contrasting choice formats (e.g., active vs. quiet, social vs. solitary) to facilitate greater differentiation among preferences (Fisher et al., 1992) and to provide a more distinct ranking of interests (DeLeon & Iwata, 1996). Enabling students to express these preferences supports their ability to act volitionally, which is a core component of self-determination and improving one’s quality of life (Wehmeyer, 2005). Each prompt contrasted with two distinct types of activities (e.g., active vs. quiet, social vs. solitary). Dialogue prompts were iteratively

refined to produce developmentally appropriate activity pairs and to ensure linguistic clarity, accessibility, and relevance for middle school learners with developmental disabilities.

ChatGPT also supported development of contrasting activity pairs within each ecological context, visually represented in Figures 1–4. The number of paired-choice items varied across contexts based on instructional priorities and practical design considerations rather than a fixed numerical structure. Prompts were refined through iterative dialogue to strengthen conceptual contrasts, developmental appropriateness, and visual engagement (e.g., solitary vs. social activities, indoor vs. outdoor environments, active vs. calm engagement), with emojis incorporated to reinforce comprehension and support multimodal understanding.

ChatGPT was selected as a development tool to efficiently generate a large, conceptually balanced set of developmentally appropriate paired comparisons across multiple ecological contexts. This process required consistent language, clear contrast logic, and instructional neutrality, which would have been significantly more time-intensive to achieve through manual drafting. Each comparison was designed to maintain visual clarity while representing key dimensions of leisure participation, such as social versus solitary, active versus passive, and real-world versus digital engagement. The resulting assessment reflects a structured comparison framework intended to support accessible and repeatable choice-making across settings.

ChatGPT facilitated rapid iteration, categorical balancing, and refinement of comparison logic during development. Universal Design for Learning (UDL) considerations were addressed by standardizing language, maintaining predictable formats, and ensuring accessible, clearly contrasted options (CAST, 2018). Cognitive load principles (Mayer, 2004) were supported by reducing unnecessary wording and maintaining simple, consistent structures across comparisons. ChatGPT generated plain-language captions and produced a downloadable PowerPoint file with comparisons organized across slides, streamlining formatting and reducing development time. Rather than replacing professional judgment, ChatGPT functioned as a design support tool, allowing the author to focus on developmental appropriateness and ecological relevance.

A Student Record Form was also developed using ChatGPT to document student responses to paired leisure activity choices across settings (home, outdoor, community, and school). For each item, the form includes brief descriptors (e.g., “creative expression vs. logical thinking”) to support interpretation of student selections and identification of patterns in interests across settings.

Option A	Option B
Play video games	Read a book
Cook or bake	Listen to music
Do a puzzle	Draw or paint
Play with a pet	Watch TV or movies
Help with chores	Use the computer
Relax on the bed	Play with toys
Organize your things	Sing or dance
Use your phone or tablet	Write or color

Figure 1. A home leisure preference comparison table using content generated with ChatGPT.

Option A	Option B
Team sports	Solo sports
Walk or run	Ride a bike or scooter
Swing at the park	Climb
Go camping	Go to the beach
Garden	Picnic and relax
Go hiking	Go swimming
Fly a kite	Go stargazing
Take nature photos	Watch animals

Figure 2. An outside leisure preference comparison table using content generated with ChatGPT.

Option A	Option B
Volunteer cleanup	Take an art or tech class
Eat at a restaurant	Go shopping
Amusement park	Watch a movie
Visit a museum	Go to a concert
Visit the library	Visit the planetarium
Visit pet store	Visit makerspace
Play at arcade	Go to sports event
See a live show	Go to coffee shop

Figure 3. A community leisure preference comparison table using content generated with ChatGPT.

Option A	Option B
Read a book	Use a computer
Listen to music	Draw a picture
Color	Do a word search
Play a learning game	Do a worksheet
Practice sports	Play board games
Go to school dance	Build a robot
Build with LEGOs	Join a school club
Be a classroom helper	Lead a group project

Figure 4. A school leisure preference comparison table using content generated with ChatGPT.

2. INVIDEO AI – CONTEXT AND INTRODUCTION VIDEOS

InVideo AI was used to develop four short, narrated videos aligned with the leisure interest assessment, with one video created for each context: home,

outdoor, community, and school. Each video was generated individually using targeted prompts specifying a brief duration (approximately 30–45 seconds), a slow pacing, and the use of simple, direct language. The scripts described examples of leisure activities and modeled how individuals make different leisure choices across settings. For example, the home video stated, “At home, people enjoy relaxing, playing games, cooking, or spending time with family,” while the community video explained, “In your community, you might visit a park, store, or library. Everyone likes different things—what do you enjoy doing?” Following generation, all videos were reviewed and edited prior to use. Revisions included replacing selected stock footage with alternative media from the InVideo AI library and refining narration using the script-editing function to reduce linguistic complexity, shorten sentence length, and improve clarity. Collectively, the videos provided background knowledge, primed understanding, and modeled diverse examples of leisure participation in an accessible format.

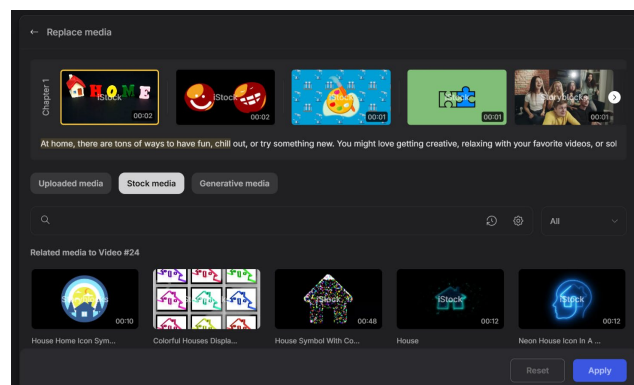


Figure 5. The InVideo AI media editing interface showing the actual video refinement workflow.

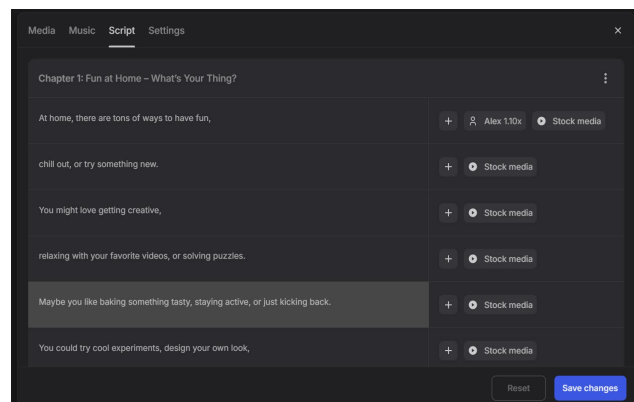


Figure 6. The InVideo AI media editing interface showing the actual video refinement workflow for video narration.

3. SORA – ANIMATED GIF DEVELOPMENT

Sora was used to generate animated GIFs that depicted movement or actions to enhance comprehension through motion cues. Example dialogue commands included: “Create a simple looping animation of a teens playing basketball at outdoor community court” (see Figure 7).



Figure 7. Example of an outdoor leisure preference GIF image created with Sora.

Two animated GIFs were created per setting, home, outdoor, community, and school, to illustrate actions such as doing crafts, watching TV, walking, exercising, playing mini golf, visiting a carnival fair, playing music in class, and playing sports, reinforcing engagement and visual understanding.

4. DALL·E AND GEMINI: VISUAL DEVELOPMENT AND REFINEMENT

AI-generated visuals were developed and refined through an iterative design process using DALL·E and Gemini embedded within Google Slides. Initial images were generated using DALL·E with prompts designed to produce age-appropriate, engaging visuals aligned to student leisure contexts. These images varied in style from simplified illustrations to more photorealistic representations, depending on the context and instructional intent, as shown in screenshots of the Google Slides assessment featuring AI-developed and refined visuals (see Figures 8–11).

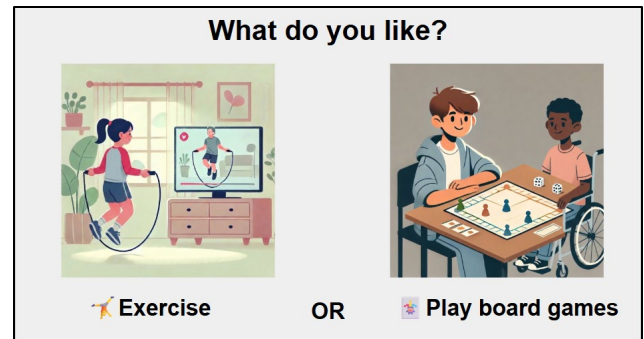


Figure 8. A home leisure preference slide.

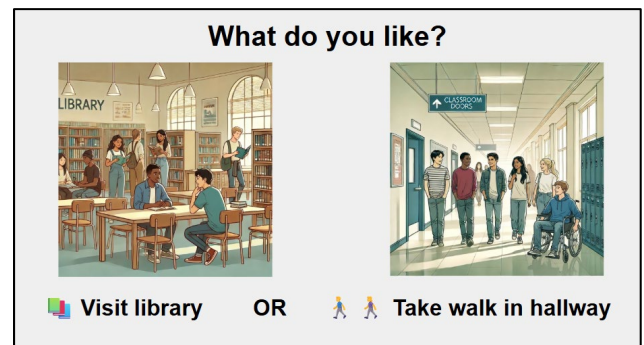


Figure 9. A school leisure preference slide.



Figure 10. An outdoor leisure preference slide.



Figure 11. A community leisure preference slide.

Images were then copied and pasted into Google Slides, where they were resized, organized, and paired with text to create structured assessment slides. This environment supported ongoing iterative refinement, allowing adjustments to layout, visual clarity, and alignment with instructional goals.

To enhance representation and accessibility, images were further refined using Gemini’s embedded editing tools within Google Slides. This secondary refinement process focused on improving cultural and racial representation, integrating visible indicators of disability (e.g., mobility aids), and increasing contextual relevance for middle school students. Edits were applied iteratively to ensure visuals were inclusive, realistic when needed, and free from unnecessary visual complexity that could distract from task demands.

Across iterations, design decisions balance realism and simplicity. Photorealistic images were used when familiarity and environmental recognition were important, while simplified or illustrative images were used to reduce visual load and direct attention to key actions or features. Variations in composition (e.g., closer perspectives) were also used to increase salience and student engagement.

This multi-step workflow resulted in a cohesive set of visuals that support accessibility, representation, and student connection to leisure activities. The process can be replicated by educators using similar AI tools in combination with iterative design and accessibility-focused principles.

IMPLEMENTATION AND FACILITATION

The multimedia leisure preference assessment was implemented across four instructional sessions aligned to ecological contexts: Home, School, Outside, and Community. Each session lasted approximately 20 minutes, including brief setup (e.g., connecting the laptop and distributing printed assessment forms) and approximately 15 minutes of structured instructional activity with pacing, prompting, and waiting time to support student regulation and engagement.

Implementation was supported by a team consisting of the classroom teacher, two instructional assistants, an interpreter, and the researcher, working with eight students. Each session began with a brief introduction to the target context using simple, direct

language (e.g., “Today we are going to look at things you like to do at home”), followed by a short (30–45 second) AI-generated video to model leisure activities and prime students for choice-making. Animated GIFs were also used to reinforce key concepts and support comprehension.

Instruction was intentionally facilitated through small-group and individualized support. The assessment slides were not projected during responding; instead, students attended to their paper-based assessment while staff provided in-the-moment support at their seats. This design reduced cognitive load by minimizing split attention between visual displays and response formats, consistent with principles of multimedia learning (Mayer, 2009).

For each item, staff delivered a standardized prompt (e.g., “What do you like?”), named each option, and supported students in identifying a selection. Students engaged one at a time and responded using pointing, verbalizations, gestures, or by marking choices on the assessment form. Staff supported participation by re-reading prompts, restating choices, and guiding responses as needed, while maintaining a neutral tone that emphasized exploration rather than correctness. Support was gradually faded across sessions as students became familiar with the routine.

Student selections were documented after each session using a structured response form, allowing efficient identification of preference patterns across contexts to inform transition and recreation planning.

STUDENT INSTRUCTIONAL SEQUENCE

Each item followed a consistent response routine. Students visually attended to two options, considered the prompt, and indicated a preference using available communication methods. Teachers provided wait time and repeated prompts as needed to support processing. This routine was repeated across paired comparisons within each session, providing a predictable structure to support engagement and decision-making.

PRACTICE AND ASSESSMENT

The activity functioned as both instructional practice and formative assessment. Through repeated exposure to the structured choice format, students

practiced visual discrimination, expressive choice-making, and self-advocacy within predictable routines. Repetition across sessions supported familiarity with task expectations while allowing teachers to observe consistency and change in preferences over time.

Assessment occurred during structured instructional sessions, with student responses recorded on paper-based forms. Student selections were documented after each session using a structured response form, allowing identification of patterns within and across ecological contexts. Teachers adjusted pacing, prompts, and wait time to accommodate variability in attention, regulation, and expressive language. No additional testing sessions were required.

TEACHER IMPLEMENTATION GUIDE

This activity is designed to support leisure-related choice-making through structured, paired visual options and supported student responding. Prior to implementation, teachers should review the multimedia leisure preference materials (e.g., slides, videos, and assessment forms) to become familiar with the structure and flow of the activity. While the assessment can be adapted for different schedules, the described implementation occurred across four sessions (approximately 20 minutes each), with one ecological context addressed per session (Home, School, Outside, and Community). Each session begins with a brief introduction to the target context using simple, direct language, followed by short videos or animated GIFs to model leisure activities and provide visual context. These visuals are used to build understanding and support connections to real-life activities prior to student responding.

Student responses are completed using printed, two-sided assessment forms rather than projected slides. Instruction is facilitated through small-group and individualized support, with teachers and instructional staff seated alongside students. This approach reduces the need for students to shift attention between a projected display and a separate response format, supporting sustained attention and accessibility. For each item, staff present a standardized prompt (e.g., “What do you like?”), name each option, and support students in identifying a preferred choice. Students may respond by pointing, gesturing, verbalizing, or marking their selection on the assessment form. Staff may repeat prompts, clarify language, or provide visual and gestural supports as needed. A neutral tone is maintained to

avoid influencing student selections, and emphasis is placed on student exploration and expression rather than correctness.

Pacing is flexible to support student regulation and engagement. Teachers provide wait time for processing and may incorporate brief pauses or breaks between items as needed. Support is gradually reduced as students become more familiar with the routine and expectations. Student responses are recorded on the assessment forms during each session. Following the session, educators transfer and organize responses using a structured record form to identify patterns of interest within and across ecological contexts. These results can be used to inform instructional planning, transition goals, and communication with families to support leisure participation across settings.

To support successful implementation, teachers may simplify language, reduce visual complexity, or limit the number of items presented based on student needs. Previewing a small number of items or incorporating movement or sensory breaks may further support engagement and participation.

CRITICAL REFLECTION

The multimedia leisure preference activity was implemented across four sessions with middle school students with developmental disabilities. Students consistently attended to the multimedia visuals, responded to preference prompts, and demonstrated sustained engagement with the structured choice-making format. Delivering the activity in short, approximately 20-minute segments supported attention and processing, and extended wait time was beneficial for several students as they considered and communicated selections.

The instructional experience met its intended purpose of teaching and practicing leisure-related choice-making. Students indicated preferences using multiple response modalities (e.g., pointing, gestures, verbal responses, or marking). Repeated opportunities to choose between two clearly defined options supported consistent expression of individual preferences. For one to two students, selections appeared to favor the first option more frequently, with occasional shifts to the second option. This pattern may reflect variable attention, uncertainty about available choices, or emerging preference for

alternate options. Importantly, these variations did not diminish the instructional value of the activity, as the primary goal was to provide repeated, supported opportunities to practice making choices. Continued implementation over time may help clarify stable preferences while further strengthening students' choice-making skills.

Multimedia components were intentionally designed using concise, explicit scripting and carefully selected stock video and animated imagery to support comprehension and engagement. However, practical constraints were evident. Available stock footage in InVideo AI has limited precision in representing some leisure activities. The impact of short introductory videos as a priming strategy in this assessment was not directly evaluated. Similarly, GIFs and static visuals were used to support understanding; however, the influence of image quality, realism, and specific visual features on student comprehension and responding was not directly evaluated. These considerations highlight the importance of continued refinement in multimedia design for instructional accessibility.

The consistent two-option choice format provided clear structure and supported accessible decision-making for students with diverse communication needs. At the same time, future iterations may explore the instructional value of presenting three or more options to increase discrimination demands, promote more nuanced preference expression, and support emerging critical thinking within supported choice contexts. Refinement of individual choice items may also yield more differentiated or context-specific response patterns across repeated administrations. Future implementations may also include increased variation in choice formats and further refinement of visual representations to better capture nuanced student preferences.

Overall, the activity integrated naturally within ongoing instruction focused on self-expression and decision-making. Future classroom use should continue to examine how structured multimedia choice formats influence the accuracy, consistency, and generalization of student choice-making across settings and time. Future research may also explore the systematic fading of direct teacher support following initial instruction, including shifting from individualized facilitation to more whole-group presentation with targeted prompting as needed. This approach may support increased independence, sustained attention, and continued development of

choice-making skills in less supported contexts, with the broader goal of strengthening students' ability to communicate meaningful preferences in authentic daily settings.

Reflecting on the technical workflow, the initial decision to utilize ChatGPT and DALL-E served as a foundational design choice for this project's rapid prototyping phase. However, as generative technology has rapidly expanded, tools like Gemini offer embedded AI image generation and edit features directly within assembly environments like Google Slides. This evolution suggests that future multimedia assessment development could be explored within a single, consolidated platform, potentially removing the need to navigate multiple disparate AI tools. Such integration would further streamline the instructional design process, significantly reducing the time required for educators to develop highly customized and accessible learning materials.

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has over a decade of experience in special education across transition programs and school-based services. He can be contacted at charlesthull@gmail.com.

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Charles Thull, PhD, is affiliated with Old Dominion University. His work focuses on transition planning, accessible instructional design, career readiness, and self-advocacy instruction for students with disabilities.

ABOUT THE AUTHOR

Charles Thull is a Middle School Resource Employment and Transition Representative in Fairfax County Public Schools, where he supports transition planning and post-secondary readiness for students with disabilities. He is a Ph.D. candidate in Instructional Design and Technology at Old Dominion University and holds an M.S. Ed. in Special Education. His work focuses on transition planning, career development, and the design of technology-supported instructional tools to promote independence and self-determination. He also develops transition assessments, curriculum, and teacher training materials, and provides professional learning and family-facing resources to support effective implementation of transition services. He

Building AI Capacity Through Coding Fundamentals: AI-Augmented Coding for Teens Using Python, Data Structures, and Verification Practices

Sidney Shapiro, University of Lethbridge

OVERVIEW

This activity helps secondary learners (grades 7–12) build artificial intelligence (AI) capacity by using a chatbot to support, not replace, foundational Python programming. In a 75–90 minute coding activity, learners choose a short project that uses lists and/or dictionaries, write a specification and test plan, ask the chatbot for a plan before coding, implement and debug the program, and verify each AI suggestion through tests, tracing, and explanation. The purpose is to connect tool awareness, prompt writing, data structures, and responsible use in one reusable activity. Major assessments include a runnable program, a Prompt and Verification Log, and a brief explanation/reflection. Setup requires 10–15 minutes plus any local approval for youth chatbot access.

Topics: AI Literacy, Python Programming, Computer Science, Secondary Education

Time: One 75-90-minute session.

MATERIALS

- Learner devices with a Python environment, such as local Python, a browser-based IDE, or Jupyter.
- Projected display for instructor modeling.
- Access to an LLM chatbot. If individual accounts are restricted, use an instructor-controlled account, a school-managed tool, or the offline AI-output-card described in the facilitation guide.
- [Prompt and Verification Log](#).
- [Instructor Facilitation Guide](#).
- [Assessment Rubric](#).
- [Project Prompts and Code Skeletons](#).

CONTEXT-AT-A-GLANCE

Setting

A multi-day camp for secondary learners (grades 7–12) in southwestern Canada.

Modality

Face-to-face; adaptable online with screen sharing, structured check-ins, and shared logs.

Class Structure

75 to 90-minute insertable activity drawn from multi-day camp blocks; pairs or triads rotate production, documentation, and verification roles.

Organizational Norms

No sensitive data entered into third-party tools; AI use documented throughout the learning process.

Learner Characteristics

Grades 7-12 with mixed coding experience; all 44 learners completed the 2024 and 2025 programs.

Instructor Characteristics

Instructor should know introductory Python, debugging, and coaching through questions.

Development Rationale

Fast AI-supported prototypes, especially in 2025, made explicit data-structure reasoning, tests, tracing, and explanation necessary before accepting AI output.

Design Framework

AI-adapted PRIMM, UDL-aligned options, collaboration roles, and responsible AI literacy practices.

SETUP

Before class, the instructor verifies that Python runs on all devices, confirms local policy for youth access to AI tools, and prepares one short demonstration showing a chatbot response that looks plausible but fails a test. The instructor prints or posts the prompt and post verification log, instructor facilitation guide, assessment rubric, and project prompts and code skeletons and decides whether starter code will be available at the beginning of the session or released after learners have attempted the task.

Setup typically takes 10–15 minutes after account access and classroom technology are available. If chatbot access is unavailable or inappropriate for the setting, the same activity can be implemented with printed “AI output cards” containing sample plans, code, and intentional defects.

STANDARDS ALIGNMENT

The activity can be aligned to local computer science, digital literacy, and technology integration outcomes. For broad transfer, it also aligns with UNESCO’s AI Competency Framework for Students through

- Attention to human agency,
- Responsible tool use,
- Critical evaluation of AI outputs,
- Practical AI literacy (UNESCO, 2024b).

CONTEXT AND SETTING

Generative AI has made natural-language-to-code workflows accessible to beginners, but novices can struggle to write useful prompts, interpret generated code, and judge whether a response is correct (Nguyen et al., 2024). Recent computing education work similarly emphasizes that LLM use should shift attention toward decomposition, explanation, testing, and debugging rather than only syntax production (Vadaparty et al., 2024; Yeh et al., 2025). For teen learners, this means that AI capacity should not be defined as the ability to obtain code quickly. Rather, AI capacity should be defined as the ability to work with AI tools while understanding the data structures, logic, tests, and design choices that make code usable.

This activity emerged from coding camps for grades 7–12. The 2024 implementation, delivered in partnership with a public library and a Canadian public university, included 19 participants. The 2025 implementation, delivered at the university, included 25 participants. The AI-specific routine was used in both years, although learners’ use of AI coding support became more visible and productive in 2025 as tools became more available.

Across the camps, learners built stock market simulators, choose-your-own-adventure games, games using dictionaries and functions, projects using external Python libraries, and map-based games that read room data from JSON or CSV files. This activity distills the reusable instructional routine that emerged from those implementations.

The activity is organized around an AI-adapted PRIMM sequence. Learners:

1. Predict what code (or an AI suggestion) should do,
2. Run it,
3. Investigate mismatches,
4. Modify the code with bounded AI assistance,
5. Make a small working feature (Sentance et al., 2019).

Instructor modeling and coaching are important during these tasks, but the activity is not presented as a full cognitive apprenticeship model. Instead, it uses modeling, role rotation, and brief articulation/reflection moments to make the normally hidden parts of AI-assisted coding visible: specification, data representation, tests, tracing, and decisions to use, modify, or reject an AI suggestion.

The activity also uses Universal Design for Learning (UDL) to support learner variability. Learners may choose among project prompts; use starter code when syntax load blocks reasoning; and demonstrate learning through code, a flowchart, or a brief spoken explanation (CAST, 2024). AI literacy is operationalized through observable actions: Identifying appropriate and inappropriate uses, writing bounded prompts, evaluating outputs, documenting assistance, and making a use/modify/reject decision before integration (Lee et al., 2024; Ng et al., 2021). Responsible AI practices are embedded through privacy rules, disclosure, and verification expectations (Miao & Holmes, 2023; National Institute of Standards and Technology, 2023; OECD, 2026).

LEARNING REPRESENTATION

LEARNING OBJECTIVES

- Identify at least two appropriate and two inappropriate uses of a chatbot as a coding support tool.
- Choose and justify a list and/or dictionary representation for a small Python task.
- Write a bounded prompt that requests a plan, assumptions, and test cases before requesting code.
- Analyze an AI suggestion for likely problems, then accept, revise, or reject it using evidence from tests, tracing, or explanation.

- Explain one design decision and one debugging or verification step to a peer or instructor.

ACTIVITY DESIGN AND FLOW

Learners work on the activity (see Table 1) in pairs or triads using simplified collaboration roles:

1. The Driver types and runs the code.
2. The Navigator reads the specification and maintains the Prompt & Verification Log.
3. When a third learner is present, the Verifier predicts output, checks tests, and challenges unsupported AI suggestions.

Roles rotate every 10–15 minutes so that every learner practices both production and reasoning.

Time	Phase	Instructor moves	Learner actions and artifacts
0–10 min	Orientation: tool role and norms	Demonstrate a chatbot response that looks correct but fails a test. Review privacy, attribution, and “verify before you trust.” Refer learners to the Prompt and Verification Log.	Review the Prompt and Verification Log and choose Driver/Navigator/Verifier roles.
10–20 min	Problem framing before AI	Model how to extract requirements, choose a list/dictionary representation, and write 3–5 tests including one edge case.	Select a project prompt, draft a specification, sketch a data model, and write initial tests.
20–30 min	Prompt for a plan, not code	Provide the plan-prompt template from the Instructor Facilitation Guide and require assumptions and test cases before code.	Prompt for a plan, compare AI suggestions with their own plan, and record decisions in the log.
30–55 min	Implementation and guided debugging	Circulate and coach with questions: “What key does the dictionary use?”, “Which test failed?”, “What line changes the list?” Release starter code only when syntax blocks the data-structure objective.	Implement one function or feature at a time. Ask the chatbot only for bounded help, such as one bug or one function.
55–70 min	Verification checkpoint	Stop the room for a short process check. Model a trace print or assertion. Ask pairs to identify one AI suggestion they accepted, revised, or rejected.	Run tests, add one edge case, trace one loop or dictionary update, and complete the verification rows in the Prompt and Verification Log.
70–90 min	Articulation and reflection	Facilitate 2–3 process shares focused on evidence, not polish. Use the Assessment Rubric criteria.	Submit the runnable program and log; explain one design decision and one verification step in writing or verbally.

Table 1. Activity flow and timing.

The instructor should describe these roles as a way to distribute attention, not as a rigid professional pair-programming model.

The instructor may use one of three project prompts from the Project Prompts and Code Skeletons: A camp inventory manager, a text-adventure micro-scene, or a quiz data model for a later web app. Each prompt requires learners to use lists and/or dictionaries. The instructor models one prompt, then either assigns that prompt to all groups for consistency or allows choice when learners are ready for more autonomy.

WHAT VERIFICATION LOOKS LIKE

Verification is the central learning move. After a chatbot suggestion, learners pause before copying the change into the final program:

1. They predict what the code should do using a concrete input.
2. They run at least three tests, including one edge case such as an empty list, missing dictionary key, invalid menu option, or quantity that would go below zero.
3. They trace the relevant state change, for example by printing the dictionary before and after an update.
4. They decide whether to use, modify, or reject the AI suggestion.

For example, if a chatbot suggests using `len(inventory)` to count total camp supplies, learners test the starter dictionary `{"water": 10, "snack": 5}`, notice that the expected total is 15 rather than 2, and modify the function to sum the dictionary values. The error becomes evidence for learning rather than a failure to hide.

STARTER CODE AND SCAFFOLDING DECISIONS

Starter code is a scaffold, not the default path for every learner. It may be provided at the beginning of the activity for groups with very little prior coding experience or released after 5–7 minutes if a group can explain the data model but is blocked by syntax. It should be withheld or partially hidden for groups ready to design independently. When starter code is used, the instructor should still require learners to fill in the specification, tests, and verification log. This preserves the learning objective: Students may

receive structure, but they still need to reason about the data and verify the code.

DIFFERENTIATION AND ACCESSIBILITY

The activity includes multiple entry points for mixed-readiness teen groups. Project choice supports motivation, while a common rubric maintains shared expectations. Learners who need reduced syntax load may use starter code or prompt stems; advanced learners may add input validation, file persistence, summary statistics, or a small Flask connection. Learners may submit a brief oral explanation, annotated code comments, or a simple flowchart in place of a longer written reflection. A no-AI path is also possible: The instructor could distribute sample AI responses or defective code cards for learners to verify and repair. This option supports settings where youth access to chatbot accounts is restricted.

EVALUATION

Evaluation focuses on observable evidence rather than tool novelty. The core indicators of success are:

- The program uses an appropriate list and/or dictionary;
- The learner group provides at least three tests and one edge case;
- The Prompt and Verification Log documents at least one AI-assisted suggestion and a use/modify/reject decision;
- Learners can explain one design decision and one verification step.

The Assessment Rubric provides additional details. In the completed camp implementations, all participants finished the program (19 in 2024 and 25 in 2025), and informal student feedback was positive. Formal pre/post assessment data were not collected; therefore, the activity should be interpreted as an implemented teaching activity with formative indicators rather than an efficacy study. Future implementations should collect brief pre/post AI-literacy reflections and completion indicators to strengthen evaluation evidence.

CRITICAL REFLECTION

This activity was refined from two completed teen coding camps and from the development of expanded 2026 camp resources. In 2024, learners were highly engaged by themed projects and built ambitious prototypes, including simulations and branching games, but progress was slower and instructors needed to provide more direct syntax and debugging support. In 2025, more accessible AI coding tools allowed learners to build more quickly, which expanded what was possible in a short camp but also made it easier for learners to accept code they could not yet explain. This contrast shaped the activity's current emphasis: AI can increase building capacity, but foundational concepts such as lists, dictionaries, functions, file structures, tests, and tracing remain necessary if learners are to work with AI rather than be replaced by it.

Instructors observed that the log and checkpoint helped shift some learner conversations from authority-based reasoning toward evidence-based reasoning. Without the log, some learners treated chatbot output as final. With the log and checkpoint, conversations more often focused on whether tests passed, which dictionary key changed, or why a list did not contain the expected item. This implementation observation supports making verification a required artifact rather than a reminder. It also supports keeping the activity small: One function, one data model, and one verified feature are enough for a meaningful 75-90 minute activity.

Two practical challenges should be anticipated. First, camp settings include varied attention, uneven prior knowledge, and time pressure. The activity works best when the instructor keeps scope small and treats extra features as extensions. Second, AI access for minors can be inconsistent. The offline output-card option is therefore not a backup of lesser value; it is a useful way to teach the same verification habits without requiring individual chatbot accounts. The next planned modification is a train-the-trainer version for peer mentors and camp assistants, plus an open educational resource package containing editable prompt cards, starter projects, and facilitator notes.

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ABOUT THE AUTHOR

Sidney Shapiro is a professor of business analytics in the Dhillon School of Business at the University of Lethbridge. His work focuses on applied data science, social network analytics, and the practical integration of artificial intelligence into learning and organizational settings. He designs technology-rich learning experiences that combine computational thinking, tool literacy, and responsible use of AI. He leads teen coding camp programming associated with the University of Lethbridge, with materials developed across 2024–2026 that support pathways from introductory Python to web applications, software development, and emerging technology topics. He can be contacted regarding this article at sidney.shapiro@uleth.ca

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Exploring Biomes and Ecosystems Using Artificial Intelligence Tools

Aishat O. Balogun¹ and Ajarat O. Balogun²,
¹Indiana University Bloomington, ²Bloomington High School North

OVERVIEW

This activity is part of a series of environmental science lessons designed for 11th–12th grade students that focuses on biomes, ecosystems, and human impacts on environmental systems. Serving as the culminating project, this activity builds on prior learning and requires students to demonstrate understanding through artificial intelligence tools. Students explore various biomes, identify ecosystems, research human impacts, and investigate strategies for sustainability. Throughout the unit, students use AI tools to create visual products and support content understanding. The activity concludes with student presentations.

Keywords: Artificial intelligence, Biomes, ecosystems, Human Impact, Sustainability

Time: 60 to 75 minutes. Multiple class sessions are required to complete all aspects of the activity.

MATERIALS

- Computer with internet and Google drive access
- Learning Management System
- Cellphones or mobile devices
- Teacher and student accounts on <https://www.magicschool.ai/>
- [Presentation](#)

SETUP

Set up teacher and student MagicSchool AI accounts and create the teacher MagicSchool AI room. Share the sign-up link with students prior to the activity. Review the AI tools students will use and ensure their easy access during the activity. Students will work in small groups so provide space for group discussions.

CONTEXT-AT-A-GLANCE

Setting

Activity designed for 11th–12th grade students in a suburban public high school in the United States.

Modality

In person

Class Structure

The activity is part of a graded science course that meets for 75 minutes every other day using a block schedule throughout the school year.

Organizational Norms

The course is a yearlong elective science option offered by the school.

Learner Characteristics

Class enrollment typically ranges from 15 to 35 students, primarily juniors and seniors who have completed other science courses but require a third science credit to meet graduation requirements.

Instructor Characteristics

Instruction is led by two high school science teachers. One has experience teaching in higher education. The other instructor has taught in international and elementary school settings.

Development Rationale

This activity serves as the culminating project in a sequence of ecology-focused topics. Students review and apply key concepts using targeted artificial intelligence tools to create artifacts demonstrating their understanding.

Design Framework

This activity is guided by the Adaptive Learning 4A Model (De Leon & Santos, 2019), emphasizing knowledge acquisition, abstraction, and contextual application.

CONTEXT AND SETTING

This activity was developed as part of a five-week environmental science unit delivered in 60–75-minute block-scheduled classes during the introductory study of environmental science and ecosystems. The course is offered at a suburban public high school in the Midwestern United States and is available as both a general credit and Advanced Placement (AP) elective within the science department. It is primarily taken by 11th- and 12th-grade students seeking a third science credit to meet graduation requirements. The activity is adaptable for both course levels, with increased rigor and depth of analysis for AP students. Typical class sizes range from 15 to 35 students. Canvas is used as the learning management system, while Google Drive supports collaboration and content sharing.

This activity intentionally integrates MagicSchool AI, an education-focused artificial intelligence platform recently adopted by the school. AI is used to scaffold research, support visualization of complex ecological relationships, and assist students in synthesizing information across biomes and ecosystems. By generating and refining artifacts such as visuals and explanatory content, students engage in higher-order thinking processes, including analysis, evaluation, and application of ecological concepts. In this way, AI enhances learning by supporting sense-making, conceptual transfer, evidence-based reasoning, and student engagement.

The activity may be delivered synchronously or asynchronously using Canvas, with Microsoft Teams or Zoom facilitating online collaboration when needed. While some components are completed in class, others may be assigned outside of class to fit within the five-week unit timeline. Students work collaboratively to research, review, and apply ecological concepts, using AI tools to create artifacts that demonstrate their understanding. Collaboration is emphasized to promote shared learning and multiple perspectives, with Google Drive used to support idea exchange throughout the project.

LEARNING REPRESENTATION

The introduction to environmental science and ecosystems unit spanned approximately five weeks and coincided with the school district’s adoption of

MagicSchool AI, an education-focused artificial intelligence platform. This activity was intentionally designed as the culminating project for the unit, allowing students to consolidate their understanding of ecological concepts while simultaneously developing proficiency with AI-supported learning tools. Students were given one week to complete the project, culminating in class presentations of their final products.

The instructional design followed a learner-centered approach aligned with the Adaptive Learning 4A framework (De Leon & Santos, 2019). Students first engaged in anchoring activities through research to activate prior knowledge. During the abstraction phase, students learned how to use MagicSchool AI tools to synthesize new information and refine their understanding. In the application phase, students integrated ecological concepts and AI tools to create artifacts demonstrating their learning. This structure ensured clear alignment between lesson objectives (concept mastery and tool fluency), assessments (research, artifact creation, and presentation), and deliverables (AI-generated products and explanations), reinforcing both conceptual understanding and applied skills.

The Adaptive Learning 4A Model (De Leon & Santos, 2019) provides a strong pedagogical framework for this activity by structuring learning around knowledge acquisition, abstraction, and contextual application. During the acquisition phase, students build foundational understanding of biomes, ecosystems, and human impacts through guided research and curated resources. The abstraction phase is supported through the use of MagicSchool AI tools, which help students synthesize information, identify patterns across ecosystems, and translate complex ecological relationships into visual and conceptual representations.

Finally, contextual application occurs as students use AI-generated artifacts to apply their understanding to real-world environmental challenges, such as sustainability strategies and human-environment interactions. By aligning AI tool use with each stage of the 4A Model, the activity

ensures that the technology supports cognitive development and conceptual transfer rather than surface-level engagement, reinforcing deeper ecological understanding and adaptive learning.

This activity is an opportunity to create an “AI ready graduate” who is an “empowered learner” using AI tools to create media, learn new skills, synthesize information, think critically and reflect while envisioning new possibilities (ISTE, n.d.). Meanwhile the instructor acts as a facilitator and guide to manage the activity as students learn how to responsibly use these tools.

TEACHER PREPARATION

Instructors are encouraged to review multiple online tutorials about how to maneuver the MaginSchool AI before the activity begins. The activities outlined here should be completed by the teacher ahead of time (before students start the activity). These include:

1. Create the teacher MagicSchool AI room (see Figures 1-8). Note: Screenshots from MagicSchool AI (<https://www.magicschool.ai>) used for instructional demonstration purposes.

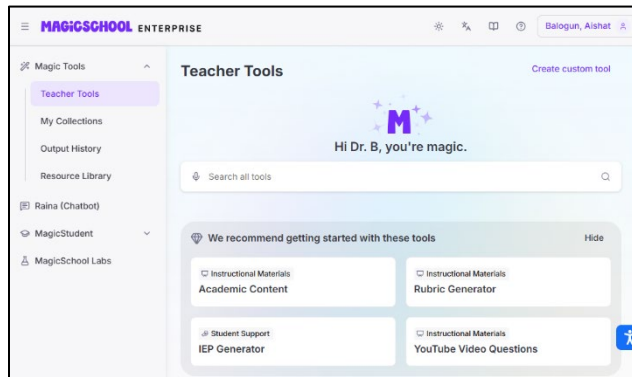


Figure 1: Image for teacher sign in page.

Remember to create rooms ahead of the activity so students can access the information and materials.

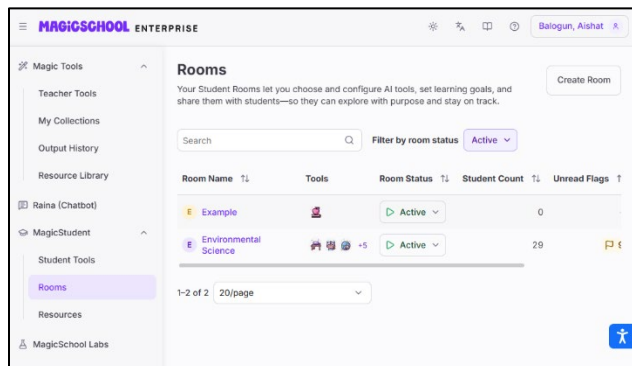


Figure 2: Create a room view from teacher dashboard.

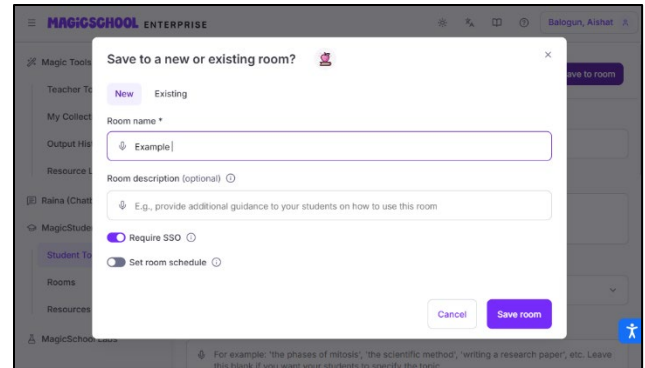


Figure 3: Save room view.

2. Add tools you want students to access to the room you created. For this activity, the tools included a study bot, student support chatbot, AI tutor, text translator, image generator, text rewriter, text summarizer, text proofreader, and Raina (another chatbot and learning assistant) for students. Teachers should pick tools they feel their students will need for the specific activity they want to complete.

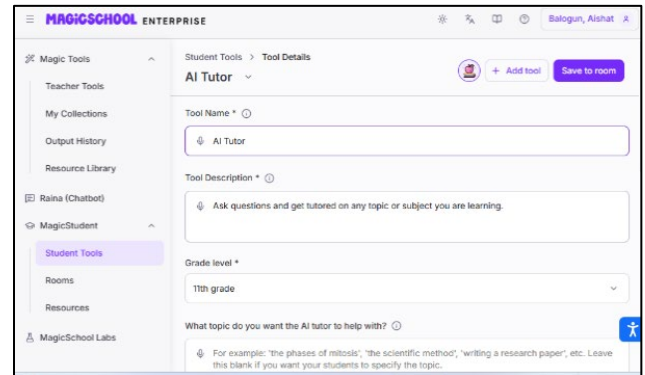


Figure 4: AI tool selection view.

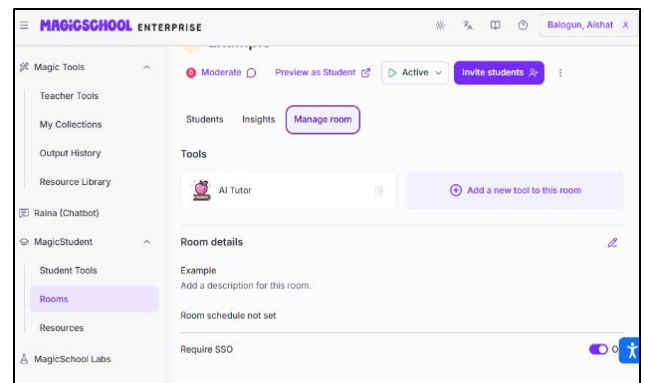


Figure 5: Example of AI tool selected view.

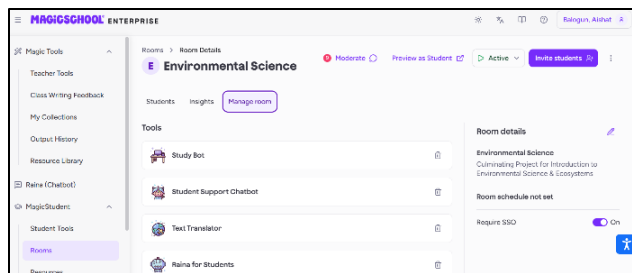


Figure 6: Manage room view to manage tools.

3. Share the sign-up link with students.

Walk students through platform sign-in. Remember to share the link to join the room you have created.

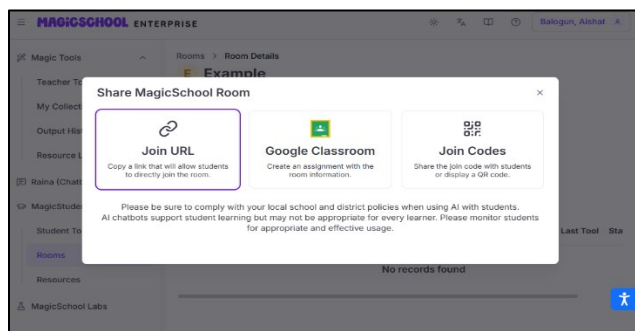


Figure 7: Option for student to sign in.

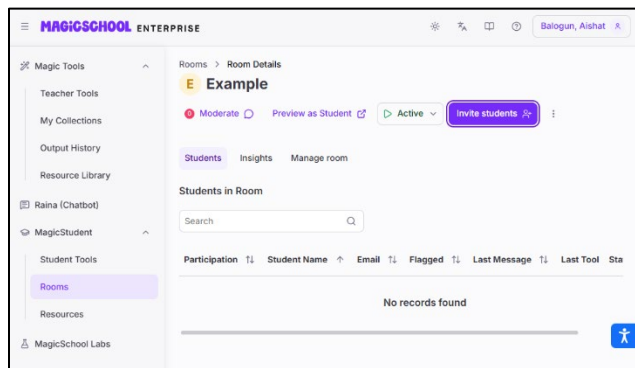


Figure 8: Invite students view.

OBJECTIVES

The following objectives guided this activity:

- Students will analyze how deforestation, urbanization, and industrialization impact biodiversity and ecosystem health.
- Students will identify renewable energy, conservation, and restoration technologies that help adapt environments to human needs.

- Students will propose strategies to sustain biodiversity considering ecological, social, and economic factors at various levels.

ANCHOR: ACTIVATE PRIOR KNOWLEDGE

The start of the activity entailed a review of ecosystem information especially focused on human impact on biodiversity and ecosystem sustainability. Using the Culminating project environmental science lecture PowerPoint, show slides 1 through 12.

Ask students questions to prompt their recall of information about the ecosystem. Some of the question prompts used are:

- *What is a Biome?*
- *What is an ecosystem?*
- *Provide examples of ecosystems!*

When examples of ecosystems are mentioned, ask questions specific to each ecosystem:

- *What threats are specific to the ecosystem mentioned?*
- *What are the impacts of these threats to the ecosystem?*

ABSTRACTION: APPLY NEW KNOWLEDGE

After reviewing slides 1 through 12, open the website for MagicSchool AI and introduce the platform. Share slides 13 through 18 for students to sign in to the platform. You can share the link to the website directly via the Canvas LMS or a QR code so students can easily access the website.

APPLICATION

This is the section that provides specific information about the project. Share the information on slides 19 through 23 with students—specifically the project purpose, focus, and deliverables.

Review how technology can be integrated in the project and share the project assignment. Specify exactly what students are supposed to deliver at the conclusion of the project. This includes the following:

- A presentation about the selected ecosystem that covers all project objectives;

- A science fiction script about the selected ecosystem, addressing human impact and sustainability in the selected ecosystem;
- A visual poster about the selected ecosystem.

CRITICAL REFLECTION

This was a very interesting and useful activity that provided an opportunity for students to use AI tools in the context of a unit. The students were able to review concepts while leveraging AI tools to demonstrate understanding of the concepts. By crafting artifacts, they were able to reflect on their grasp of the course content, which was one of the objectives of the activity.

The activity was very successful in getting the students to engage with new technology without making it an activity focused just on learning how to use AI tools. The students felt it made learning about the tools more fun since it was in the context of what they were working on. The AI tools appeared to provide students with more options to conclude a project.

Students were also glad that the tools they used (e.g., the text rewriter, text translator, and text summarizer) made it easier for them to express themselves. For instance, the text rewriter was very helpful in generating a movie script that the groups used to express what they felt about how to save or manage their selected ecosystems. It enabled students to be creative with the solutions they proposed for revitalizing destroyed ecosystems. Students also said the AI tools made the concepts they were learning more vivid. This made the activity come alive by including tools that enabled students to portray real life implications in various formats like posters and movie scripts.

From an instructor perspective the AI tools provided an opportunity for students to think critically, reflect on their work, review the strengths and weaknesses of various tools, and reinforce that AI tools are not replacements for their efforts. Rather, these tools are a means to improve efficiency.

CHALLENGES

While the project was successful and students appreciated the opportunity to use AI tools that could

portray their work and assist in generating the materials, there were a few challenges.

Making the students review the ecological concepts at the same time as completing the project was challenging for some of students. These students felt they were playing catch up and trying to grasp the information while learning new things. This overlapped structure disrupted to how they learned.

Adjustments had to be made that allowed students to become more familiar with the tools before using them for the activity. This made the project period last longer than what we had anticipated (hence the note at the beginning of this activity regarding time). Next time, we would spend more time during previous lessons to show examples of how to use the tools before letting students begin the project.

PERSONAL BELIEFS AND CHOICES

Although the use of AI tools was a major component of this activity, some students shared their apathy or hesitation with these tools. Limiting students to AI tools made a few unhappy. These students felt they should not be required to use tools for the project that they did not agree with.

While we were surprised with these comments, we respected student choices and allowed flexibility in the use of AI tools to complete the project. For instance, one student refused to use AI tools for visual illustrations. However, the same student used another app to draw their visuals.

COPYRIGHT CONCERNS

One project submission that students completed was a movie script about the ecosystem. Students used the text rewriter tool to complete this aspect of the project. Since the tool rewrote existing information, most students used an existing movie synopsis as the prompt generator. The result was a script that closely resembles the existing movie. This could be regarded as plagiarism if shared outside the classroom. However, for this activity we asked students to share their original movie synopsis and discussed how far they could share the resulting material and how they should cite the source document.

FUTURE MODIFICATIONS

While the activity was considered a success, it is apparent that some modifications would make it better. These include:

- Providing more specific and targeted rubrics that emphasize copyright implications.
- Including a section that explicitly teaches students how to frame prompts used for the AI tools (thereby reducing the risk of copyright infringement when creating multimedia materials).

Instructors should also take into consideration the digital divide that may exist in the classroom between tech savvy students and reluctant users. The means making sure group dynamics are considered to ensure all groups have those who are active users of technology (creators, analyst) and passive users of technology (content consumer).

CONCLUSION

Overall, this activity was successful in meeting its objectives. The students were glad with their finished work and appreciated the opportunity to act as AI tool reviewers. Although some struggled initially, they adapted quickly to the use of these tools. The activity was a great way to review scientific concepts while learning and applying new skills.

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ABOUT THE AUTHORS

Aishat Olere Balogun likes to read, travel, and create multiple opportunities for students to extend STEM outside the school/classroom curriculum. Her interests include science education; STEM; and the intersection of technology, learning, and its application to education. She is currently a 9th - 12th grade science teacher, an adjunct professor, and a Fulbright specialist.

Ajarat O Balogun has taught both elementary math and high school science for a couple of years in various countries. She loves to read, cook, travel and explore ways to improve her teaching across various contexts. She is currently exploring teaching science in the American high school system.

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AI as a Lesson-Planning Partner in Preservice Teachers' Mixed-Reality Rehearsal

Nelson Cubas and Susie L. Gronseth, University of Houston

OVERVIEW

This lesson helps undergraduate preservice teachers (PSTs) use artificial intelligence (AI) ethically and strategically during lesson preparation. PSTs engage in a structured cycle of lesson internalization, optional AI-supported planning, peer feedback, and mixed-reality teaching rehearsal. PSTs analyze provided digital citizenship lessons, complete a guided internalization worksheet, and decide when and how AI tools can support brainstorming, perspective-taking, organization, and instructional clarity. PSTs reflect on AI use and non-use through low-stakes planning and simulation observation tasks to build awareness of appropriate purposes, limitations, and ethical considerations when integrating AI into instructional planning.

Topics: AI Prompting For Teachers, Classroom Management, Ethical AI Use, Instructional Strategies, Lesson Internalization, Mixed-Reality Simulations

Time: 2–3 class sessions (120-180 minutes total)

MATERIALS

- [Lesson Internalization Lecture Slides](#)
- [Mursion Activity Lecture Slides](#)
- [Microteaching Rehearsal Lecture Slides](#)
- [Lesson Internalization Activity Worksheet](#)
- [Lesson Internalization Activity Example](#)
- [Critical Friends for Lesson Internalization Activity](#)
- [Integrating Peer Feedback Activity](#)
- [Thought Partner Activity](#)
- Four ISTE digital citizenship lessons (ISTE, n.d.)
- Generative AI assistant (ChatGPT, Gemini, etc.)
- [Mursion mixed-reality simulation platform](#)
- Zoom link for Mursion session
- Padlet simulation observations discussion board

CONTEXT-AT-A-GLANCE

Setting

Undergraduate educational technology course at a large, urban, Hispanic-serving institution in the southern United States.

Modality

Face-to-face instruction with synchronous mixed-reality simulation delivered via Zoom. Simulation may be replaced with microteaching rehearsal.

Class Structure

Lesson internalization and AI modeling occur during a single class, followed by an independent rehearsal period and a mixed-reality experience.

Organizational Norms

The program emphasizes practice-based teacher education, district-aligned lesson preparation routines, reflective teaching, and responsible technology integration.

Learner Characteristics

PSTs in the Grades 6–12 certification program. Most have limited teaching experience and a strong interest in instructional technology.

Instructor Characteristics

The instructors are a doctoral teaching fellow and an instructional technology faculty member experienced in facilitating mixed-reality learning experiences and using AI in lesson planning.

Development Rationale

To equip PSTs with strategies for internalizing provided curriculum materials while discerning appropriate uses of AI in lesson planning.

Design Framework

Practice-based instructional sequence emphasizing rehearsal, feedback, and reflection before enactment.

SETUP

Prior to implementation, the instructor reviews the three digital citizenship lessons available for student selection and prepares an instructor-modeled lesson internalization example using a fourth lesson. The instructor also reviews [Mursion](#) avatar profiles to anticipate instructional and behavioral dynamics and sets up the Padlet discussion boards in advance of the simulation. This instructional preparation requires approximately 60–90 minutes prior to the week of implementation.

Implementation occurs across two, one-hour and 45-minute class sessions. The first session introduces lesson internalization, provides instructor modeling, and orchestrates peer and optional AI mediation.

The second session centers on mixed-reality teaching rehearsal using Mursion and structured peer observation using Padlet. Instructor preparation involves logistical and technical setup, including launching the Mursion environment, setting up Zoom projection, and testing audiovisual functionality. Instructors should allocate approximately 20-30 minutes of pre-class setup for these tasks.

STANDARDS

This lesson supports the International Society for Technology in Education (ISTE, 2016; 2017) standards for students and educators. Specifically:

- ISTE (2016) Student Standards:
 - 1.3 Knowledge Construction
 - 1.6 Creative Communicator
- ISTE (2017) Educator Standards
 - 2.5 Designer
 - 2.6 Facilitator

CONTEXT AND SETTING

This learning representation was implemented in an undergraduate educational technology course designed to prepare secondary preservice teachers (PSTs) for teaching in digitally mediated classrooms. The course emphasized practice-based teacher preparation and supported PSTs in developing instructional readiness when working with pre-designed or district-aligned curriculum materials. As teachers are increasingly expected to enact district

provided curricula, lesson preparation involves internalizing instructional moves, anticipating student thinking, and preparing for enactment decisions rather than authoring lessons from scratch (Narayanan et al., 2024).

In this course, we frame lesson internalization as a professional planning routine through which teachers interpret curriculum materials to anticipate instructional flow, student responses, and potential points of difficulty prior to teaching. In this regard, lesson internalization emphasizes interpretive judgement, adaptability, and anticipatory thinking that support instructional decision-making during enactment. This framing aligns with research on practice-based teacher education, which highlights the importance of preparing teachers to reason through the instructional complexity before entering a live classroom setting (Grossman et al., 2009).

The course incorporates mixed-reality simulation through the Mursion platform. [Mursion](#) (n.d.) combines artificial intelligence with a live simulation specialist to create real-time interactions with avatar students. The simulations enable PSTs to rehearse instructional moves in low-stakes environments. Prior research demonstrates that mixed-reality simulations can support teacher learning by approximating classroom complexity and providing opportunities to rehearse instructional strategies, classroom management, and student engagement while retaining space for experimentation and reflection (Dalinger et al., 2020; Dieker et al., 2023; Runge et al., 2025). Thus, we selected Mursion for use in this lesson to support short lesson enactments focused on practicing lesson openers and early engagement routines.

Generative artificial intelligence (AI) tools were available as optional support during lesson preparation. Though AI use in teacher education coursework is an emerging area, recent research suggests that AI tools have potential use as cognitive planning scaffolds for brainstorming, organization, and anticipatory thinking; however, authors caution that these tools should be used selectively and critically rather than as a substitute for critical judgement (Lu et al, 2025; Nguyen & Barbieri, 2025). Furthermore, research highlights that PSTs' decisions to adopt, limit, or avoid AI use are shaped by ethical considerations, professional identity, and instructional context (Cooper et al., 2025; Wen & Wen 2025). Therefore, we position AI use in this course as a professional judgment exercise within lesson

preparation that maintains that preservice teachers retain responsibility for justifying their instructional reasoning and decision-making.

LEARNING REPRESENTATION

LEARNING OBJECTIVES

By the end of the lesson, PSTs will be able to:

- Identify and refine key components of a pre-designed lesson through guided lesson internalization.
- Anticipate student thinking, questions, and engagement challenges prior to lesson enactment.
- Integrate constructive peer and optional AI feedback into lesson planning decisions.
- Explain how collaborative and AI-supported planning influences instructional confidence and readiness for teaching practice.


GRADING

All lesson activities are structured as low-stakes course assignments to prioritize rehearsal, professional reasoning, and instructional practice rather than performance-based evaluation. The completion of the lesson internalization worksheets in the first session is assessed as a low-stakes assignment. At this early stage of the lesson, grading of the worksheet is based on completion of and engagement with the planning process rather than the quality of instructional decisions. PSTs' participation in mixed-reality teaching and associated post-teaching reflective writing on a Padlet digital board are also assessed as a low-stakes assignment to promote emphasis on participation and reflective engagement during rehearsal.

SESSION 1: LESSON INTERNALIZATION

The lesson begins with PSTs selecting one of several pre-designed digital citizenship lesson plans for learners in the middle grades. These lessons are framed as district-provided instructional materials

Mursion Student Avatar Profiles

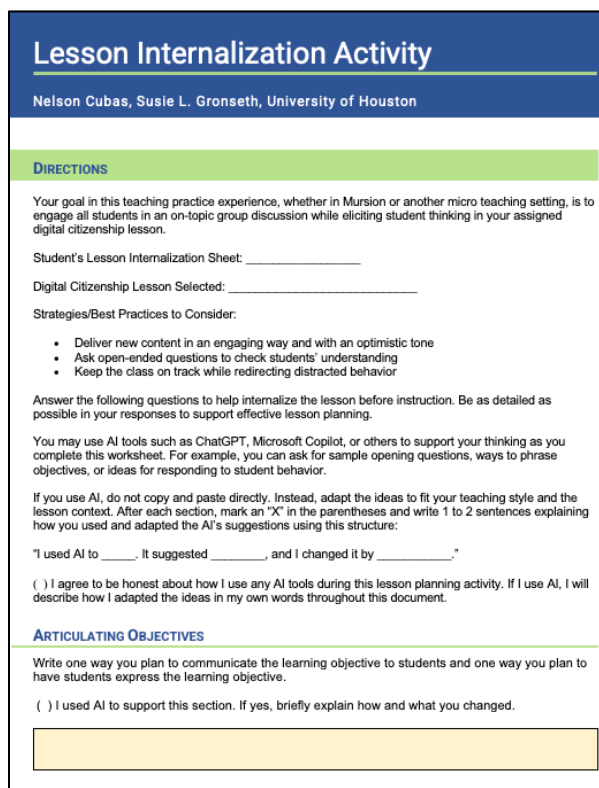


<p>Student Avatar A</p> <p>Super objective: To be accepted as an individual Behavior: Introverted, honest and loyal, repressed feelings/ can be overloaded</p> <p>Academic Profile</p> <ol style="list-style-type: none"> 1. Excellent data memory & recall 2. Perfectionist, potential for procrastination but will get the job done 3. Likes a quiet work environment (solo or library) 4. Responds best to learning and engaging with clear directions and what is expected of her <p>Instructional Tip</p> <p>Be clear and structured. Don't put her on the spot. Acknowledge her effort quietly if needed.</p>	<p>Student Avatar B</p> <p>Super Objective: To impress intellectually Behavior: Introverted, intelligent, driven, thoughtful</p> <p>Academic Profile</p> <ol style="list-style-type: none"> 1. Self-driven with high standards 2. Can stay unbiased with a sense of order and calm 3. Comfortable with a sense of order and calm 4. Enjoys working through a challenge <p>Instructional Tip</p> <p>Let him explore ideas. Use open-ended or high-level thinking questions. Respect his slower pace.</p>	<p>Student Avatar C</p> <p>Super Objective: To control (to be liked, to be admired, to control, to be recognized) Behavior: Extroverted, can be condescending/sarcastic</p> <p>Academic Profile</p> <ol style="list-style-type: none"> 1. Enjoys leadership roles 2. Quick thinking - decisive 3. Dislikes slowing down because someone else "doesn't get it" and busy work 4. Responds negatively to being controlled and/or being called out by a teacher. <p>Instructional Tip</p> <p>Channel her leadership, make her group lead or discussion starter. Avoid power struggles.</p>	<p>Student Avatar D</p> <p>Super Objective: To please Behavior: Social introvert, empathic, people pleaser, creative</p> <p>Academic Profile</p> <ol style="list-style-type: none"> 1. Very bright, naturally does well in school 2. Can get very passionate about certain subjects, especially science and animal related subjects 3. Craves human understanding but uncomfortable in social situations (thus the comfort with Student Avatar C's friendship) 4. Avoids conflict (will help find a middle ground with everyone) <p>Instructional Tip</p> <p>Use inclusive language. Encourage her voice apart from Ava. Recognize her compassion.</p>	<p>Student Avatar E</p> <p>Super Objective: To impress Behavior: Extrovert, playful, supportive, energetic</p> <p>Academic Profile</p> <ol style="list-style-type: none"> 1. Often volunteers in class, doesn't mind stepping out of his comfort zone 2. Always tries to understand new perspectives 3. Difficulty paying attention when work is detailed or mundane 4. Seeks attention and approval from peers - naturally funny <p>Instructional Tip</p> <p>Keep him engaged with quick transitions. Assign class energizer roles (e.g., warm-up reader, closing summary).</p>
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Figure 1. Mursion student profiles for PSTs, based on Mursion (2022).

that must be enacted within a constrained instructional context. PSTs are situated in a scenario in which they teach a short homeroom lesson where they have limited instructional time and, therefore, need efficient lesson openers and engagement strategies. This homeroom experience is later simulated using Mursion. PSTs are given student profiles (see Figure 1) to prepare for this scenario.

The PSTs then complete a guided Lesson Internalization worksheet (see Figure 2) designed to prompt anticipatory instructional thinking to support preparation for teaching practice in Mursion or another microteaching setting. Prompts guide PSTs to articulate lesson objectives in student-friendly language, identify central concepts, consider how to activate students' prior knowledge, anticipate potential student questions or misconceptions, plan possible lesson openers, prepare responses for off-task behavior, and identify diverse learner supports.



Lesson Internalization Activity
Nelson Cubas, Susie L. Gronseth, University of Houston

DIRECTIONS

Your goal in this teaching practice experience, whether in Mursion or another micro teaching setting, is to engage all students in an on-topic group discussion while eliciting student thinking in your assigned digital citizenship lesson.

Student's Lesson Internalization Sheet: _____

Digital Citizenship Lesson Selected: _____

Strategies/Best Practices to Consider:

- Deliver new content in an engaging way and with an optimistic tone
- Ask open-ended questions to check students' understanding
- Keep the class on track while redirecting distracted behavior

Answer the following questions to help internalize the lesson before instruction. Be as detailed as possible in your responses to support effective lesson planning.

You may use AI tools such as ChatGPT, Microsoft Copilot, or others to support your thinking as you complete this worksheet. For example, you can ask for sample opening questions, ways to phrase objectives, or ideas for responding to student behavior.

If you use AI, do not copy and paste directly. Instead, adapt the ideas to fit your teaching style and the lesson context. After each section, mark an "X" in the parentheses and write 1 to 2 sentences explaining how you used and adapted the AI's suggestions using this structure:

"I used AI to _____. It suggested _____, and I changed it by _____."

() I agree to be honest about how I use any AI tools during this lesson planning activity. If I use AI, I will describe how I adapted the ideas in my own words throughout this document.

ARTICULATING OBJECTIVES

Write one way you plan to communicate the learning objective to students and one way you plan to have students express the learning objective.

() I used AI to support this section. If yes, briefly explain how and what you changed.

Figure 2. Lesson internalization worksheet sample.

PSTs are instructed that they may use AI tools such as ChatGPT and Microsoft Copilot to ask for help with internalizing the lesson. The instructor teaches them how to download the ISTE digital citizenship lesson (ISTE, n.d.) as a PDF and upload it to the chatbot to request feedback regarding the specific

lesson. The instructor mentions that PSTs can use AI to ask for help in any of the sections in the worksheet by writing tasks such as "help me come up with two questions that middle grade students would ask in this lesson plan," or "what are some important concepts that students would need to already know prior to being presented this lesson?"

PSTs are then asked to document whether AI tools were used for individual worksheet sections and explain how AI-generated suggestions were used and adapted in their own words. They are instructed to follow the template "I used AI to _____. It suggested _____, and I changed it by _____." PSTs are encouraged to make deliberate decisions about when AI meaningfully supports instructional reasoning and when it does not.

INSTRUCTOR MODELING AND GUIDE WORK

The instructor models the lesson internalization process using another example lesson to establish expectations and norms. Sample instructional decisions are discussed in each worksheet section, illustrating how planning decisions can be connected to anticipated student responses and lesson flow. Ethical and strategic AI use is modeled during this walkthrough. The instructor demonstrates how AI tools may be used to support brainstorming or perspective-taking while explicitly narrating moments where AI-generated suggestions are revised or rejected. For example, the instructor highlights instances in which AI responses lack depth or overstep professional norms, such as proposing language inappropriate for teachers to use or offering guidance related to parent-child negotiations. In these cases, the instructor explains why such suggestions require thoughtful adaptation or should be declined. PSTs are explicitly instructed not to directly copy or paste AI-generated language into their worksheets but to use the AI-generated suggestions in ways that help them think through their instructional planning decisions. They are reminded that they remain responsible for all instructional decisions and original wording.

PEER AND AI FEEDBACK

Following the completion of the initial lesson internalization worksheet, PSTs engage in a structured sequence of peer and AI feedback to help deepen their instructional reasoning. PSTs first

exchange their completed lesson internalization worksheets with an assigned peer (referred to as their “critical friend”), and the partners provide targeted and constructive feedback on the PSTs’ written lesson internalization responses using a guided Critical Friends for Lesson Internalization Activity worksheet (see Figure 3).

summarize their peers’ feedback for improvements, and briefly explain what they changed and why as they rewrite the section in their own words to reflect instructional improvements. This step aims to reinforce the expectation that feedback should inform their instructional reasoning rather than be applied uncritically.

Figure 3. Critical friends for lesson internalization activity worksheet.

The feedback prompts focus on strengthening anticipatory instructional thinking in each worksheet section rather than evaluating lesson quality. PSTs are asked to provide specific and actionable suggestions in one or more areas related to lesson objectives, openers, main concepts, activation of prior knowledge, anticipated student questions, support for diverse learners, or classroom management strategies.

After completing the critical friend’s activity, PSTs complete an Integrating Peer Feedback into Lesson Internalization Activity worksheet (see Figure 4), whereby they select one section of their lesson internalization worksheet to revise based on their critical friend’s feedback. They are instructed to document the original version of the selected section,

Figure 4. Integrating peer feedback into lesson internalization activity.

Following this revision, PSTs use AI to obtain additional insights. Using a structured AI as a Lesson Planning Thought Partner Activity worksheet (see Figure 5), they select the same section from the peer review to request feedback through an AI chat, such as Microsoft Copilot, ChatGPT, Gemini, Claude, etc. On the worksheet, they document their AI prompt, the full AI response, and their decision to adapt, partially adapt, or decline the suggestion, along with a brief explanation. PSTs then revise their lesson internalization worksheet accordingly and submit the completed lesson materials for class credit. Instructors may also choose to collect both original and revised versions of the lesson internalization activity worksheet to make changes across the feedback process more visible.

Artificial Intelligence as a Lesson Planning Thought Partner Activity

Nelson Cubas and Susie L. Gronseth, University of Houston

INSTRUCTIONS

After you receive feedback from your critical friend and revise one section of your lesson internalization worksheet, submit that same section to one chatbot tool, preferably Microsoft Copilot or another tool you know. Ask the AI for one clear strength and one concrete suggestion for improvement for that section only. Record the prompt you used, the AI response, and whether you adapted, partially adapted, or declined the suggestion with a brief explanation. Place an "X" in the parentheses for the option you choose.

Note: This step follows your peer feedback revision. Use the same section you revised so you can compare the AI's feedback with your peer's advice and consider how both may strengthen your final version.

- Student's Lesson Internalization Sheet: _____
- ISTE Lesson: _____

SECTION A

I am improving (choose one)

- Articulating Objectives
- Practicing Lesson Openers
- Identifying Lesson Plan's Main Concepts
- Activating Students' Prior Knowledge
- Predicting Students' Hypothetical Questions
- Preparing for Diverse Learners
- Managing Classroom Behavior

Paste your revised version of that section from your lesson internalization worksheet.

SECTION B

Chatbot used (choose one)

- Microsoft Copilot
- ChatGPT
- Gemini
- Other: _____

Write the prompt you gave to the AI below. Include the grade level, topic, and the section you wanted help improving. Review the example prompt.

Figure 5. AI as a lesson planning thought partner activity.

INDEPENDENT REHEARSAL PREPARATION

Following the class session, PSTs retain their revised lesson internalization planning materials to use for independent rehearsal in preparation for the upcoming teaching practice experience, such as a mixed-reality simulation or peer microteaching rehearsal. During this time, PSTs are coached to continue to refine and practice for that experience using the materials as flexible planning references. They mentally rehearse lesson openers, anticipate student responses, and refine instructional transitions.

As they review their materials, PSTs are prompted to reflect on how their planning decisions may unfold when they try them out in the simulation. PSTs are invited to revisit their use of AI as well to explore additional engagement strategies or clarify anticipated student questions. They are also told they can choose to intentionally avoid additional AI use. Both approaches are framed as valid and productive towards instructional readiness.

SESSION 2: MIXED-REALITY REHEARSAL

In the second session, PSTs engage in a mixed-reality teaching rehearsal using Mursion. Each PST has the opportunity to deliver their lesson opener and initial instructional moves from their selected digital citizenship lesson. Teaching segments are intentionally limited to approximately five to six minutes to emphasize rehearsal of instructional decision-making in the opening portion rather than teaching the full lesson.

While each PST teaches, their peers observe the interaction between the PST and the avatar students. Peers are assigned rotating observer roles using a shared Padlet discussion board to structure observation and promote analytic noticing. Padlet (<https://padlet.com/>) is a collaborative digital bulletin board that allows participants to post brief written responses in real time, enabling multiple observers to document instructional observations during each enactment (see Figure 6).

The figure shows four screenshots of Padlet cards, each with a unique role for peer observation during a simulation. Each card is from 'edtech' and posted '2 months ago'. The roles and their prompts are:

- Teacher Observer:** "What did you observe about the teacher?"
- Student Observer:** "What did you observe about the students?"
- Question Raiser:** "What other questions or concerns does watching this session raise for you?"
- Advice Giver:** "What might you suggest that the teacher do differently?"

Each card also includes a set of instructions: "Your role is just to describe. Try not to give advice or judge. Just be a mirror." (for Teacher and Student Observers) and "Give 1-2 concrete examples of what 'doing it differently' might look like?" (for Advice Giver).

Figure 6. Peer observation roles in Padlet.

During each simulation, one group of peers focuses on describing the teacher's instructional moves, another attends to student responses and engagement, a third identifies questions or tensions raised by the interaction, and a fourth offers concrete suggestions for how instructional moves might be adjusted. After each PST completes their simulation, observers rotate roles so that all students engage with multiple analytic perspectives across enactments. This rotation supports distributed attention and prevents any single enactment from being reduced to evaluative feedback alone. PSTs

take screenshots of their completed posts and compile them onto Google Docs or Microsoft Word documents to showcase their participation in peer feedback during the simulations.

DEBRIEF AND GUIDED REFLECTION

Finally, the class engages in a structured whole-group debrief to support collective sensemaking and reflective analysis of the simulation experience. The instructor facilitates a guided reflection that draws on both PSTs' teaching experiences and the Padlet observation posts.

Debrief prompts focus on planning and instructional responsiveness, including questions about how PSTs felt in their anticipation of student questions or comments, how they responded when unexpected interactions occurred, how classroom dialogue unfolded, and which teaching or learning moments were most salient during the simulations. These prompts are designed to help PSTs connect lesson internalization decisions to how they enact instructional practices and in-the-moment pedagogical reasoning. Padlet entries are revisited during the debrief to surface patterns across observations, highlight shared challenges, and identify instructional strategies that support student engagement and classroom management.

CRITICAL REFLECTION

The lesson was initially developed and piloted in Spring 2025 in two in-person sections of the educational technology course. It was subsequently refined and implemented again in two Fall 2025 course sections. A total of 81 PSTs participated in the lesson activities across these four course sections. Institutional Review Board (IRB) approval was obtained prior to post-semester analysis of student worksheets.

We reflected on multiple data sources generated through the learning representation, including the Lesson Internalization Activity worksheet, Critical Friends for Lesson Internalization Activity worksheet, Integrating Peer Feedback into Lesson Internalization Activity worksheet, and AI as a Lesson Planning Thought Partner Activity worksheet. We also relied on data from Padlet observation posts completed during the mixed-reality simulations, instructor field notes,

and student reflections. These artifacts provided insight into how PSTs reasoned through their lesson preparations, engaged with peer and AI feedback, navigated decisions about when and how AI supported their instructional thinking, and perceived value in the activities.

Across the implementations, more than 50% of PSTs agreed or strongly agreed with the statement, "The structure of the lesson internalization sheet helped me stay on track during the Mursion session." In the final course reflections, many PSTs identified the lesson internalization and mixed reality rehearsal sequence as one of the most meaningful components of the course. For example, one PST remarked, "The Mursion activity was phenomenal and very fun... I had a blast taking the skills I learned in my student observations this semester and using them in this activity." Another student mentioned, "Another assignment that was really fun was when we had to do the interactive simulation with the middle schoolers. I was really nervous to participate, but it gave me a feel for what it could really look like when I am in the classroom. I feel as if I had a good experience and even saw what I need to improve on."

A smaller subset of PSTs reported experiencing moments of difficulty during the simulation, especially when responding to unexpected student behaviors. Some also struggled with maintaining lesson pacing or adapting when classroom dialogue diverged from the anticipated responses. These remarks suggest that although the worksheets supported lesson planning, the simulation exposed the PSTs to the kinds of instructional decisions and uncertainties they must learn to navigate during early teaching practice.

Together, these data sources indicate that the lesson supported PSTs in developing instructional preparedness and reflective awareness of their planning and enactment process. It served to foreground lesson internalization as a professional planning practice and to position AI as an optional support for instructional reasoning rather than a prescriptive solution. The structured prompts encouraged PSTs to surface assumptions about student understanding, anticipate potential misconceptions, and consider how instructional choices might unfold during mixed-reality enactment. The sequencing emphasizes anticipatory thinking, rehearsal, and comparison across feedback sources to help PSTs make deliberate decisions about instructional preparation prior to enactment.

The low-stakes assignments in the lesson, including the lesson internalization worksheet and the mixed-reality teaching practice, positioned lesson preparation as a rehearsal opportunity meant to foster confidence and growth. In this way, lesson preparation, feedback, and simulation-based rehearsal served as formative experiences embedded within the course rather than as high-stakes assessment tasks. This design supports experimentation, ethical decision-making, and reflective practice without discouraging risk-taking through potential performance pressure.

The first session class period allowed sufficient time for the PSTs to complete the internalization worksheet, exchange feedback, revise one selected section, and, if desired, consult an AI tool for an additional comparison. This pacing structure was intentionally designed to prevent cognitive overload and procedural rushing while preserving space for deliberation, revision, and instructional reasoning.

The AI-generated feedback activity was intentionally sequenced after peer feedback and applied to the same section students had already revised based on their peer's suggestion, so that the human-mediated instructional reasoning remained the primary source of revision. AI was viewed as one perspective among several rather than as an authoritative source. This sequencing foregrounds deliberation and comparison across feedback sources and supports PSTs in examining how peer and AI input differentially inform instructional clarity, student perspective-taking, and professional judgement.

Padlet responses were completed in real time and emphasized description, interpretation, and questioning rather than judgment. This structure encourages PSTs to connect their lesson internalization decisions to observable teaching practice, student behavior, and instructional contingencies. After the simulation rehearsal, Padlet entries supported whole-group discussion on alignment between planned instructional moves and enacted practice, as well as areas where instructional reasoning may need revision.

The debrief centered on instructional reasoning, decision-making processes, and the relationship between planning, enactment, and adaptation. Together, the lesson internalization activities, feedback structures, simulation rehearsal, and guided reflection led PSTs in lesson preparation as a dynamic, adaptive professional practice rather than a

static document task. This design reframes planning as a form of instructional rehearsal that supports anticipatory thinking, pedagogical judgement, and professional sensemaking prior to classroom enactment.

INSTRUCTIONAL DESIGN REFLECTIONS

PSTs engaged in the lesson in ways that suggested that the lesson internalization activity functioned as more than a preparatory checklist; instead, it operated as a cognitive planning scaffold that supported anticipatory reasoning, instructional coherence, and professional sensemaking prior to enactment. Analysis of student worksheets, reflections and observational data indicated that PSTs increasingly treated lesson internalization as an interpretive process through which they reasoned about instructional flow, student thinking, and pedagogical decision-making.

The integration of peer feedback and optional AI comparison further supported PSTs in examining their instructional reasoning from multiple perspectives without positioning any single source as authoritative. An important takeaway is that AI's role in the learning representation needed to remain bounded by design. Engaging with AI after initial planning and peer feedback encouraged PSTs to develop and articulate their own instructional intentions before consulting AI tools. This structure allowed PSTs to critically evaluate AI-generated suggestions and decide whether they meaningfully contributed to instructional clarity or student perspective-taking.

The mixed-reality rehearsal further transformed planning into enacted cognition by making the relationship between anticipatory reasoning and in-the-moment instructional action visible. Simulation-based teaching and structured observation supported analytic noticing of how internalization decisions shaped classroom interaction, student responses, and instructional contingencies. Planning, enactment, and reflection became cognitively linked rather than pedagogically separated. This process was done strategically to allow PSTs to experience preparation as an adaptive reasoning cycle. The learning representation thus frames instructional planning as a site of epistemic development where professional knowledge is constructed through sensemaking, evaluation, and adaptive decision-making.

LIMITATIONS & FUTURE REFINEMENTS

The mixed-reality rehearsal focused on brief lesson openers rather than full lessons, which constrained opportunities to examine sustained instructional decision-making. AI use was optional, resulting in varied levels of engagement that limit direct comparison between AI-supported and non-AI-supported planning approaches. Additionally, the lesson involved a single simulation cycle, which restricted opportunities for iterative rehearsal and revision. Another limitation is that access to mixed reality platforms such as Mursion may not be available in all teacher preparation programs due to financial or technological constraints.

Future implementations can address limitations by incorporating multiple rehearsal cycles, expanding enactments beyond lesson openers, and designing structured opportunities for PSTs to compare planning decisions across repeated simulations. When mixed-reality platforms are not available, instructors can modify this lesson internalization activity by using peer microteaching rehearsals in which PSTs practice lesson openers for classmates who role-play student responses. To make this adaptation more feasible in teacher preparation settings with fewer technological resources, we also include lecture slides for a microteaching rehearsal format in addition to the Mursion-specific slides. The lesson internalization materials and rehearsal components may also be adapted for either individual or small-group implementation, depending on class size, available time, and instructional goals. These refinements aim to deepen PSTs' understanding of lesson internalization and further support reflective, judgment-centered engagement with AI within professional instructional practices.

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ABOUT THE AUTHORS

Nelson Cubas is a doctoral researcher in Curriculum and Instruction at the University of Houston with a focus on Learning, Design, and Technology. His research examines how mixed-reality simulations and AI-supported rehearsals can help future teachers connect lesson planning to real-time instructional decisions. He may be contacted at nwcubas@gmail.com.

Susie L. Gronseth is a Clinical Professor in the Learning, Design, and Technology program area in the College of Education at the University of Houston. She specializes in learning technologies, instructional design and evaluation, health sciences education, and the application of Universal Design for Learning (UDL) to address diverse learner needs in online, face-to-face, and blended contexts. She can be contacted at slgronseth@uh.edu.

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AI – Supported Digital Storytelling

Hua Bai, Northeastern Illinois University

OVERVIEW

This lesson plan outlines a learning unit in which a group of preservice teachers (PSTs) explored both AI in education and educational uses of digital storytelling, then integrated AI into a digital storytelling project. The PSTs used an instructor-created custom chatbot to support script writing, then employed AI image generation programs to create visuals for their digital stories. Finally, they used a video creation platform to record their own voice overs and synthesize all media elements into a cohesive storytelling video.

Topics: Generative AI (GenAI), Teacher education, Digital storytelling

Time: Three weeks, with one 2.5-hour class meeting in the first and third week. No class meeting was held in the second week.

MATERIALS

- [MagicSchool \(free plan\)](#)
- Instructor-created [custom chatbot](#)
- [AI in Education presentation](#)
- [Digital storytelling assignment and rubric](#)
- AI image generation programs ([Adobe Firefly](#), [Canva Magic Studio](#), [ChatGPT](#) or other generative AI tools that can create images)
- Video creation platforms ([Adobe Express](#) or [Canva](#), etc.)
- Computer (Desktop or laptop with [Zoom](#))

SETUP

There was one synchronous class session on Zoom during the first week and one during the third week, each lasting 2.5 hours. The second week was asynchronous learning in Desire2Learn.

CONTEXT-AT-A-GLANCE

Setting

A four-year public state university located in the Midwestern United States

Modality and Class Structure

Instruction combines synchronous Zoom sessions in weeks one and three with asynchronous learning in Desire2Learn during week two.

Learner Characteristics

The learners were 16 licensure-seeking PSTs in a graduate-level instructional technology class, with diverse undergraduate backgrounds, not all in education.

Instructor Characteristics

The instructor should have knowledge about digital storytelling and AI in education. They should demonstrate skills in integrating AI into educational contexts, including developing custom chatbots using AI platforms, and using AI tools for tasks such as image creation.

Development Rationale

Through this activity, PSTs gain hands-on experience integrating AI into education, thereby preparing them to apply these skills in their future teaching practice.

Design Framework

Guided inquiry can significantly and positively affect student learning (Lazonder & Harmsen, 2016). In this learning unit, various supports were employed including explanation (readings, the instructor's presentations, and instructions), heuristics (project document), and scaffolds (project document, custom chatbot, and other resources).

STANDARDS

The learning unit was implemented in an instructional technology class for preservice teachers enrolled in master's degree programs. The following ISTE Standards for Faculty (International Society for Technology in Education, 2025) and Standards for Educators (International Society for Technology in Education, 2024) align with the learning.

FOR FACULTY

Instructor-Design learning opportunities: Faculty design learning opportunities that integrate digital tools and resources, foster innovative, inclusive learning experiences, and equip students to use technology in the workforce.

Leader-Model and share effective use: Faculty mentor colleagues and students by modeling and sharing effective use of technology in teaching, research, and service.

Leader-Ethical and responsible behaviors: Faculty model ethical and responsible behaviors by promoting the safe, legal, and responsible use of technology in academic and professional practices.

FOR EDUCATORS

2.1 Learner: Educators continually improve their practice by learning from and with others, and exploring proven and promising practices that leverage technology to improve student learning.

2.1.a Set professional goals: Educators set professional learning goals to apply teaching practices made possible by technology, explore promising innovations, and reflect on their effectiveness.

2.5 Designer: Educators design authentic, learner-driven activities and opportunities that use technology to accommodate learner variability.

2.5.b Design authentic learning activities: Educators design authentic learning activities that incorporate technology to advance student outcomes and develop opportunities for students to apply their knowledge.

2.6 Facilitator: Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students.

2.6.d Model and nurture creativity: Educators model and nurture creativity and creative expression to communicate ideas, knowledge or connections.

CONTEXT AND SETTING

The learning unit was implemented in an instructional technology class required for all PSTs in master's degree programs in elementary education and middle-level education. In this class, PSTs learn to utilize technology to enhance teaching, learning, and authentic assessment. Digital storytelling is a topic in this class, as it is a powerful tool in education (Robin, 2016). PSTs in this class are required to create a digital storytelling video for instructional purposes. In this project, writing a script is essential. Based on the instructor's past experience with PSTs in this class, some students tended to create instructional presentations instead of stories when working on the digital storytelling project. Of the seven elements of storytelling (Robin, 2008), emotional content and a dramatic question were often unidentifiable or missing in their stories. Visual elements are also important in a digital storytelling video. Students usually had difficulties getting copyright-free images that reflected the themes or aligned with the narratives.

AI has advanced significantly over the past decades, progressing from symbolic and predictive systems to generative AI (GenAI), which is a powerful technology capable of creating content including text, images, videos, and code (Pratschke, 2024). GenAI chatbots use large language models to process natural language and generate human-like responses based on users' prompts. They can engage in dialogue, answer questions, provide explanations, generate content, and assist users in various tasks. Due to these features, using chatbots in education helps to enhance accessibility, provide personalized learning experiences, and support subject-specific development (Jusoh & Kadir, 2025). AI chatbots can be customized to serve as specialized pedagogical tools tailored for specific class needs. A custom chatbot can act as a tutor, a coach, or a course assistant that provides students with targeted support (Bruff, 2025).

Given the educational potential of GenAI, teacher educators need to help PSTs develop skills in using GenAI tools, exposing them to innovative instructional strategies, and equipping them with the knowledge to use AI ethically and effectively in K-12 classrooms. Therefore, in this instructional technology class, AI in education is also an important topic. Due to the time constraints in this class, digital storytelling and AI in education were introduced to PSTs simultaneously. AI was not only a learning topic but also integrated into the digital storytelling project to model the use of AI. Specifically, the PSTs interacted with a custom chatbot to improve script writing and then used AI image generation tools to create visual elements to support storytelling. Finally, they recorded their narrations, synthesized them with the visuals, and produced a video using a video creation platform. To make the project manageable and help the PSTs stay on track, the project was broken down into three steps with interim deadlines.

To use AI to provide PSTs with personalized learning and support their script writing, the instructor created a custom chatbot hosted by MagicSchool. MagicSchool is an AI platform dedicated to K-12 education and offers a free plan for individual teachers. The custom chatbot feature on MagicSchool allows teachers to create a chatbot by providing instructions and uploading materials to train the chatbot to offer an immediate and personalized tutoring experience to students. The custom chatbot used by the PSTs in this learning unit was trained to provide feedback on the story scripts that they created. It could not write the script for the PSTs. To share the chatbot with them, the instructor first created a student room in MagicSchool using the “Rooms” feature and then added the “Custom chatbot” tool to the room for the students to use. The instructor was prompted to create the chatbot by following the directions. The students were able to access the “room” in which the chatbot was located by either using a web link or scanning a QR code.

The PSTs took this instructional technology class in the first semester of their graduate studies. Some students were enrolled in the elementary education program; the others were in the middle-level education program. Self-introduction during the first class meeting revealed that students generally felt confident learning new technologies and were interested in exploring how technology could be integrated into their future teaching practice. Nine PSTs indicated that they had not previously used any AI tools or programs. Therefore, AI in education was

introduced when the PSTs began working on the digital storytelling project.

The class was offered remotely and adopted a bichronous mode that combined synchronous and asynchronous learning to offer flexibility to the PSTs who were also working professionals (Martin et al., 2020). The learning unit was implemented over three weeks. Weeks one and three each included a synchronous class meeting via Zoom lasting 2.5 hours. The PSTs were required to turn on their webcams and mute their microphones when not speaking during each class meeting. The second week consisted of asynchronous learning, during which the PSTs followed the structured and detailed instructions posted in Desire2Learn to engage with course materials and work on course assignments at their own pace. Throughout these three weeks, different types of guidance were provided to scaffold the PSTs’ inquiry and exploration. They could also access the learning materials in Desire2Learn. The instructor held five virtual office hours each week and responded to the PSTs’ inquiries and questions via email.

LEARNING REPRESENTATION

WEEK ONE

INTRODUCTION

In the first week, the PSTs explored digital storytelling as a powerful tool to enhance instruction and learning experiences. To prepare them to use AI tools, the instructor introduced the topic of AI in education during the synchronous class meeting. The PSTs then planned to design a digital story and created a story script for their future students. They could use the custom chatbot created by the instructor to brainstorm story ideas, but they had to create the story script independently.

CONTENT PRESENTATION

The instructor gave a presentation about AI in education that covered the following content:

1. Concepts of AI, machine learning, deep learning, and GenAI: The introduction of these concepts

- helped the PSTs understand how well-known AI tools, such as ChatGPT and Gemini, work (slides 2-3).
2. Limitations: Understanding the limitations of AI can promote responsible and ethical use of AI (slide 4).
 3. GenAI and its integration into education: This knowledge helped the PSTs understand the potential benefits of GenAI in education and how to integrate it into educational contexts (slides 5-7).
 4. Prompt engineering: The PSTs needed to learn effective prompting techniques to get desirable AI output (slides 8-9).
 5. AI models for teachers: The instructor introduced three popular AI platforms for schools and teachers (slide 10).
 6. Concerns and impacts: The PSTs needed to be informed of common concerns about using AI in education and its impacts on the environment and society (slides 11-12).
 7. Responsible use: It was necessary to highlight responsible use of AI in the presentation (slides 13-14).

During the presentation, the instructor checked the PSTs' understanding, invited them to ask questions, and encouraged them to share thoughts at intervals to maintain their motivation and engagement. Zoom polls and other interaction tools such as Slido were also used to support interactions between the instructor and PSTs.

Following the presentation, the instructor informed the PSTs that they would have hands-on experience with AI integration by producing a digital storytelling video. This project involved interacting with an AI chatbot to support story script writing and using AI image generation tools to create visuals.

To align the chatbot with this specific learning unit, the instructor provided the following pedagogical instructions when creating the custom chatbot using MagicSchool.

You are a friendly and knowledgeable teaching assistant, called ET, in an instructional technology class. The students in this class are graduate students from an elementary education program and a middle-level education program. They are preservice teachers. One topic in this class is digital storytelling. The students learn to create a digital story to support teaching and learning in their future teaching practice. One

important step in this project is to create story scripts. As the teaching assistant, you need to answer their questions about storytelling in education, help them brainstorm ideas for this project, provide feedback on their story scripts, provide improvement suggestions, and help them to improve the script. You cannot write the scripts for them or create an outline for their story. If they ask any questions and discuss anything irrelevant to storytelling in education, you need to remind them and pull them back to the right track.

Please note that your responsibility is to help with the story scripts. Of the elements of digital storytelling, pacing of the narrative and audio soundtrack are not needed in the story scripts.

Although the storytelling strategy was not new to the PSTs, they needed to intentionally explore educational uses of digital storytelling. Since not all the PSTs had undergraduate backgrounds in education, readings were assigned. There were two journal articles and one online article that were accessible through Desire2Learn. These articles were also designated as the specific knowledge that the custom chatbot should have and were uploaded to MagicSchool when developing the chatbot.

Robin, B. R. (2016). The power of digital storytelling to support teaching and learning. *Digital Education Review*, 30, 17-29. <https://revistes.ub.edu/index.php/der/article/view/16104>

Robin, B. R. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. *Theory into Practice*, 47(3), 220-228. <https://doi.org/10.1080/00405840802153916>

Goek, S. S. (n.d.). *Keeping up with...digital storytelling* Retrieved April 2, 2026 from https://www.ala.org/acrl/publications/keeping_up_with/storytelling

PRACTICE

The PSTs were asked to practice prompt engineering techniques using different AI tools and then compare the outputs. They were also asked to familiarize themselves with the custom chatbot before using it for the digital storytelling project.

ASSESSMENT DELIVERABLE

Step one of the digital storytelling project was shared with the PSTs in Desire2Learn. For this assignment, they were required to create an original story script independently. They could use the chatbot to brainstorm ideas if they wanted, but they could not use AI to generate the script. To prepare the PSTs to seek feedback on their scripts from the chatbot, the instructor intentionally did not provide specific comments on their work.

WEEK TWO

INTRODUCTION

In the second week, the PSTs continued learning about AI in education. Meanwhile, they interacted with the custom chatbot to receive feedback on their story scripts and improve their script writing. Since this week's learning was asynchronous, all instructions and materials were posted in Desire2Learn.

CONTENT PRESENTATION

To further explore the topic of AI in education, the PSTs were instructed to read four articles, including journal articles and online articles, to examine different perspectives on AI in education. They accessed the full text of the journal articles through the university library website.

Nadelson, L. S., Walthall, B., Faidley, E. W., & Filer, J. (2025). Generative artificial intelligence in teaching and learning: Concerns, practices, and supporting student use. *The Journal of Educational Research*, 118, 535-546. <https://doi.org/10.1080/00220671.2025.2511229>

Adisa, I. O., & Adefisayo, A. O. (2025). Middle school students' perspectives on adopting generative AI in K-12 education. *The Journal of Educational Research*, 118, 724-735. <https://doi.org/10.1080/00220671.2025.2510393>

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Boles, S. (2025, September 19). *How AI could radically change schools by 2050*. The Harvard Gazette. Retrieved April 2, 2026 from https://news.harvard.edu/gazette/story/2025/09/how-ai-could-radically-change-schools-by-2050/?utm_campaign=25-09-23_AI-in-Education-Newsletter&utm_medium=email&utm_source=interncom

To continue their hands-on experience with AI and digital storytelling, the PSTs were instructed to work on step two of the digital storytelling project.

PRACTICE

The PSTs continued using the custom chatbot to support the digital storytelling project, while learning more about AI in education through readings.

ASSESSMENT DELIVERABLE

When working on step two of the digital storytelling project, the PSTs were required to upload the story script they developed in step one, interact with the chatbot to seek feedback, critically evaluate the feedback, and then revise the story script. They highlighted the revisions in the final story script document. In addition, they were required to submit another document specifying what AI suggestions had been adopted, what suggestions had been rejected, and the rationale for each decision.

The instructor reviewed the PSTs' final version of their story scripts, their interactions with the custom chatbot, and their evaluations of the AI feedback. Since the PSTs began working on step three of the project after submitting the final scripts and there was insufficient time for a turn-around of instructor comments and student revisions before that, the instructor did not grade the story scripts or the PSTs' interactions with the chatbot. The instructor did not provide comments on the PSTs' final scripts unless a serious issue was present in the work.

WEEK THREE

INTRODUCTION

In the third week, the PSTs continued exploring the use of AI in education and working on the digital storytelling project by using AI tools. By the end of week three, they produced a digital storytelling video.

CONTENT PRESENTATION

The synchronous class meeting in week three started with a class discussion in which all the PSTs were invited to share their thoughts after reading the articles assigned in week two. This opportunity allowed them to reflect on their learning in relation to their hands-on experience using the chatbot when working on the first two steps of the digital storytelling project and to express their own perceptions.

After free exchange of ideas, the instructor engaged the PSTs in a role-play activity. The entire class was divided into four stakeholder groups representing teachers, students, administrators, and parents. The PSTs volunteered to join one of the groups. Then, each group joined a Zoom breakout room to have a group discussion. By the end of the group discussion, each group drafted a statement from the perspective of their assigned role that summarized the group's overall stance on AI in education and was supported by at least one citation from the readings. Also, each group provided three recommended actions that they thought the school should take. After the group work, the entire class reconvened and each group reported to the class and took questions.

The role-play activity was followed by an exploration of using AI tools to generate images, including prompting techniques and a list of AI tools that the PSTs could use when creating images for the digital storytelling project. The PSTs were directed to read the following webpage to learn to prompt AI to create images:

Harvard University Information Technology. (2023, November 16). *Getting started with prompts for image-based Generative AI tools*. Retrieved April 2, 2026, from <https://www.huit.harvard.edu/news/ai-prompts-images>

PRACTICE

The PSTs practiced using various AI image generation tools, including, but not limited to Adobe Firefly, Canva Magic Studio, and ChatGPT. An [image prompting practice game](#) (Google Arts and Culture, 2023) was shared with the PSTs in Desire2Learn so they could practice at their own pace. The PSTs also explored how to create a video in which their voice recordings of the story script were combined with the images. They could use a video creation tool of their choice, such as Adobe Express or Canva, to create the video. These practices prepared them to work on step three of the storytelling project.

ASSESSMENT DELIVERABLE

By the end of week three, the PSTs completed step three and created a digital storytelling video that met the requirements specified in the project document available in Desire2Learn. A couple of PSTs asked whether they could use photos taken by themselves or copyright-free online images to better reflect the themes of their stories. The instructor agreed and offered flexibility.

After the PSTs submitted the complete project, the instructor graded their work using the assessment rubric in the project document. The instructor made comments on their story scripts, their interactions with the chatbot, the images used in the video, their voiceover recordings, and the overall quality of the storytelling video.

CRITICAL REFLECTION

The learning unit on AI in education and digital storytelling was implemented once. Assessment of the PSTs' digital storytelling projects, especially comparison between the PSTs' initial and final story scripts, revealed that the custom chatbot helped the PSTs improve their work. Based on the instructor's observations, two storytelling elements were usually missing in PSTs' scripts of instructional stories: 1) a compelling question or narrative tension to keep the audience engaged, and 2) emotional content to build personal connection. The chatbot identified the lack of these elements and made suggestions in its feedback to the PSTs. It also detected issues in clarity, style, sentence structure, and overall flow of writing to assist the PSTs in enhancing the quality of

script writing. Therefore, in this learning unit, the custom chatbot acted as an effective tutor to support the PSTs in developing the story scripts. Nevertheless, there were lessons learned regarding the use of the chatbot.

First, when creating the custom chatbot in MagicSchool, it would have been helpful if more specific instructions had been provided. In the instructions given to the chatbot that the PSTs used in this learning unit, pacing of the narrative and audio soundtrack were excluded from the digital storytelling elements. Since the chatbot was intended to improve script writing only, the instructor should also have specified in instructions that no feedback was necessary on personal voiceover to keep the chatbot's feedback focused on script writing.

Second, the PSTs accessed the chatbot using a designated link to the student "room" where the chatbot was in MagicSchool. Their interaction with the chatbot was a one-time attempt and the chat was not saved. Therefore, each time they joined the room and had a conversation with the chatbot, it was a new conversation. In this way, the instructor could have had PSTs interact with the chatbot in one sitting or advised the PSTs to save the chat history for future reference. The instructor can also send each PST a copy of their conversation with the chatbot, as the instructor can view the details of all PSTs' chat history.

Third, some PSTs did not engage in iterative interactions with the chatbot. The project document stated, "Your interactions with the chatbot are expected to be iterative, as you may ask for clarifications and have questions about the feedback and suggestions." It was necessary to emphasize this requirement more strongly and ask the PSTs to engage in iterative interactions with the chatbot. This would have ensured deeper engagement with the feedback process and promoted critical evaluation of AI-generated feedback through follow-up questions while working to improve their script writing.

In addition, when using AI tools to create images, some PSTs seemed to have difficulty creating images that reflected the themes of their stories. Prompting AI to create images involves a fundamental shift in thinking compared to text generation, as it requires users to account for spatial composition and visual details (Liu & Chilton, 2022). Therefore, more time spent on discussing how to use AI tools to create images and scaffolding PSTs to

create appropriate images for their stories would have been helpful. PSTs may also need more time for practice.

In the future, the instructor will make modifications to address the lessons and gaps discussed above. Additionally, the instructor will consider sequencing the topic of AI in education before the topic of digital storytelling. This may require adjusting the course schedule. Ideally, there will be two weeks exclusively focusing on AI in education before digital storytelling is introduced to the class. When having PSTs work on the digital storytelling project, the instructor will adopt the Peer and AI Review + Reflection (PAIRR) model that combines peer and chatbot feedback (Sperber et al., 2025). Specifically, when working on the digital storytelling project, PSTs will have an opportunity to receive peers' feedback before asking the custom chatbot for feedback, and then reflect on their experience and critically evaluate and compare the peers' feedback with the AI-generated feedback. This will enable them to better understand the potential and limitations of AI in education while using it to support their script writing.

The lessons learned underscore the importance of thoughtful design when incorporating AI into educational contexts. It is in the hope that this practice and reflection provide a helpful reference for other instructors who want to implement a similar lesson and leverage AI tools in teacher preparation.

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ABOUT THE AUTHOR

Dr. Hua Bai is a Professor in the Educational Foundations and Community and Teacher Leaders programs. She has more than 20 years of experience teaching instructional technology courses at both undergraduate and graduate levels. Her research interests include integrating emerging technology into classrooms, e-learning design and development, and AI applications in education.

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Teaching Prompt Engineering as a Core AI Literacy Skill in Undergraduate Education

Scott Turner, University of Richmond

OVERVIEW

This learning representation introduces undergraduate students to prompt engineering as a structured, iterative practice rather than an ad hoc interaction with generative AI tools. Students design, test, and refine prompts within a domain of their choosing, documenting each iteration and evaluating outputs for accuracy, relevance, and ethical considerations. The activity emphasizes transparency, reflection, and intentional AI use, positioning prompt engineering as both a technical and metacognitive skill. By engaging students in guided experimentation and revision, the assignment supports AI literacy while reinforcing critical thinking, communication, and documentation skills applicable across academic and professional contexts.

Topics: Artificial Intelligence, Prompt Engineering, Artificial Intelligence Literacy, Generative AI, Ethical AI Use

Time: One 75-minute class session, plus one take-home assignment

MATERIALS

- Laptop for each learner
- Generative AI tool (e.g., ChatGPT, Claude, or equivalent free-tier access)
- [Prompt engineering lab instructions document](#)

CONTEXT-AT-A-GLANCE

Setting

The lesson occurred at a public, four-year, accredited university in the northeastern United States.

Modality

Asynchronous online, synchronous online, and in-person.

Class Structure

Upper-division undergraduate course; one 75-minute session per week; mixed technical and non-technical student backgrounds.

Learner Characteristics

Students range from AI novices to working professionals; no programming prerequisites required, making the lesson accessible across business, healthcare, education, and other non-technical disciplines.

Instructor Characteristics

Instructor with experience in artificial intelligence, data analytics, and applied machine learning; adaptable to diverse student backgrounds and professional contexts.

Development Rationale

Generative AI is increasingly present in higher education, yet students often lack guidance on effective, ethical AI interaction (Chen et al., 2020; Zawacki-Richter et al., 2019). This lesson makes AI use explicit, transparent, and assessable by framing prompting as a learned technical skill.

Design Framework

Kolb's (1984) Experiential Learning Theory combined with active learning principles (Bonwell & Eison, 1991; Felder & Brent, 2009), emphasizing hands-on experimentation, reflection, and iterative refinement.

CONTEXT AND SETTING

This lesson was developed and implemented within an undergraduate artificial intelligence and machine learning course at a public four-year institution's School of Professional and Continuing Studies. The course serves a diverse student population with an average age of 37, with 81% enrolled part-time, reflecting a mix of traditional students and working professionals seeking career advancement or professional development (Mew, 2020). The course was designed as part of expanding data analytics offerings, building upon successful program implementations that demonstrated effective pedagogical approaches for accommodating diverse student preparations and balancing theoretical depth with practical applicability.

The prompt engineering lesson was strategically positioned as Unit 2, early in the course sequence, to establish foundational problem-solving skills that would support independent learning throughout subsequent units. This early placement was intentional, as prompt engineering serves as a meta-skill enabling students to effectively utilize AI tools for learning support, code debugging, and concept exploration. By introducing prompt engineering before more complex topics like machine learning algorithms or neural networks, students develop self-directed learning capabilities essential for navigating rapidly evolving technologies.

The course structure accommodates students from complete beginners to experienced professionals, with no formal prerequisites beyond basic computer literacy. This accessibility was achieved through careful tool selection emphasizing free, cloud-based platforms requiring only internet access and free accounts. Technology infrastructure requirements were minimized to reliable internet access and free Google accounts for cloud-based tools, eliminating traditional barriers of software licensing, hardware specifications, and technical support complexity.

Tool selection emphasized entirely free platforms including ChatGPT or equivalent free-tier generative AI tools, GitHub for industry-standard repository management, and cloud-based environments accessible through web browsers. This approach ensured broad institutional accessibility while maintaining professional relevance, as students gained experience with tools used by software developers, data analysts, and cybersecurity

professionals in real-world settings. The cloud-based infrastructure provided consistent computing resources for diverse student populations while preparing students for professional collaborative development environments.

The lesson has been delivered in three formats: asynchronous online, synchronous online, and in-person. In the asynchronous format, students complete all content, activities, and lab work independently within a weekly time window. In the synchronous format, students meet via videoconference for the 75-minute class session, with the lab completed asynchronously. In the in-person format, a computer lab with one device per student is required for the hands-on lab component. All three formats use the same instructional framework and assessment structure. Class sections typically enrolled 15-25 students, enabling personalized feedback and collaborative learning while maintaining a manageable assessment workload for the instructor.

Accessibility considerations were built into the lesson design from the outset. The no-prerequisite structure, free tool selection, and industry-agnostic problem framing ensure that students with varying academic backgrounds, technical experience levels, and professional contexts can engage meaningfully with the material. Students with limited prior exposure to AI are supported through structured scaffolding, concrete examples, and a pre-formatted document template that reduces cognitive load. The multiple delivery formats (asynchronous, synchronous, and in-person) further extend access to learners with different scheduling constraints, connectivity limitations, or learning preferences. Instructional materials also follow general web accessibility practices (e.g., WCAG guidelines), including clear text structure, multimodal resources, and alternative formats where applicable. These design choices reflect a deliberate commitment to broad access rather than narrow technical gatekeeping.

LEARNING REPRESENTATION

INTRODUCTION

The instructor begins the lesson by posing a provocative question to students: "Why do two

people get very different answers from the same AI tool?" This opening question immediately engages students' prior experiences and surfaces common frustrations with generative AI systems. Students are invited to share brief examples of their interactions with AI tools, focusing on moments of frustration, inconsistency, or surprising results. Common themes that emerge include receiving generic responses that do not address specific needs, getting different answers when asking the same question multiple times, or struggling to get the AI to understand context or nuance.

This discussion naturally leads to a key insight: AI output quality is heavily dependent on input quality. The instructor guides students to recognize that effective AI interaction requires skill and intentionality, not just luck or intuition. The instructor then introduces prompt engineering as the systematic practice of designing inputs that reliably produce useful, accurate, and appropriate outputs. This definition emphasizes that prompt engineering is not guesswork or trial-and-error, but rather an iterative technical process that can be learned, practiced, and refined.

The introduction establishes prompt engineering as a critical AI literacy skill, positioning it alongside other foundational competencies like information literacy or digital citizenship (Long & Magerko, 2020; Ouyang & Jiao, 2021). Students learn that prompt engineering enables them to move beyond passive consumption of AI outputs to active, intentional interaction with these systems. This framing shifts students' mental model from viewing AI as a magic black box to understanding it as a tool that requires skillful operation, similar to how effective database queries or search strategies require specific techniques and knowledge.

CONTENT PRESENTATION

PROMPT ENGINEERING FRAMEWORK

Students are introduced to a structured prompt engineering framework consisting of five essential components: Context, Instructions, Output Format, Rules, and Examples. This framework provides a repeatable structure that students can apply across diverse applications and domains.

Context establishes the background information the AI needs to understand the task. This includes defining who the AI should act as (role-based prompting), who the user is, and what the broader situation or goal entails. For example, "Act as a senior data scientist reviewing code for a healthcare compliance application" provides context about the AI's role, domain expertise, and the specific application area. Context can also include subject matter background, user experience level ("I am a beginner in machine learning"), or situational context ("This will be used in a professional stakeholder presentation").

Instructions provide clear, specific directives telling the model exactly what to do. Effective instructions are unambiguous and actionable. Weak instructions like "Tell me about transformers" produce generic responses, while strong instructions like "Explain how transformer neural networks work in natural language processing, focusing on the attention mechanism and its advantages over previous architectures" guide the AI toward specific, useful outputs. Instructions should break complex tasks into clear steps.

Output Format specifies exactly how results should be structured and presented. This might include requesting bullet points, numbered lists, tables, JSON format, markdown, or specific document structures. For example, "Format your response as a table with columns for concept, explanation, and example" ensures consistent, usable output. Specifying output format is particularly important when students need structured data for further analysis or when outputs will be integrated into other systems or documents.

Rules establish constraints, dos and do nots, and boundaries for the AI's behavior. These might include tone requirements ("Use professional but accessible language suitable for a general business audience"), length constraints ("Provide a 200-word summary"), or content restrictions ("Do not include personal opinions or unverified claims"). Rules help students control AI behavior and ensure outputs meet specific requirements for their intended use.

Examples (few-shot learning, a technique in which the prompt includes a small number of demonstration input-output pairs to guide the model's response) provide sample inputs and desired outputs that demonstrate the pattern or style students want. Including 2-3 examples helps the AI understand the expected format, depth, and approach. For instance, showing examples of how to

explain technical concepts to different audiences helps the AI adapt its explanation style appropriately.

The instructor demonstrates how small changes in any component can significantly alter outputs. For example, the same question (“What should I do with \$10,000?”) produces noticeably different responses depending on whether role-based context is included. Without context, the AI might respond: “You could invest in stocks, bonds, a savings account, or pay down debt, depending on your goals.” With the context “Act as a financial advisor speaking to a first-generation college graduate with no investment experience,” the response shifts to a structured, audience-aware recommendation that addresses emergency funds, risk tolerance, and long-term planning in accessible language. The role-based context changed not just the tone but the depth, structure, and relevance of the output. Similarly, modifying output format from paragraph text to a structured table transforms how information is presented, and changing rules about length or tone produces different levels of detail and formality. These demonstrations help students understand why undocumented AI use leads to inconsistent results and why systematic prompt engineering produces more reliable outcomes.

THEORETICAL FOUNDING

The prompt engineering framework is grounded in Kolb’s (1984) Experiential Learning Theory, which provides a four-stage learning cycle particularly well-suited to iterative prompt development (see Figure 1; McCarthy, 2010). In the concrete experience stage, students engage directly with AI tools, writing initial prompts and observing outputs. During reflective observation, students analyze what worked and what did not, comparing different prompt variations and their resulting outputs. Abstract conceptualization occurs as students learn the framework components and understand why certain prompt structures produce better results. Finally, active experimentation happens when students apply their understanding to refine prompts and test new approaches.

This cyclical learning process mirrors professional AI development workflows where practitioners iteratively test, observe, conceptualize, and experiment with different approaches. The framework provides structure for this iterative process, preventing random trial-and-error while encouraging systematic exploration and refinement.

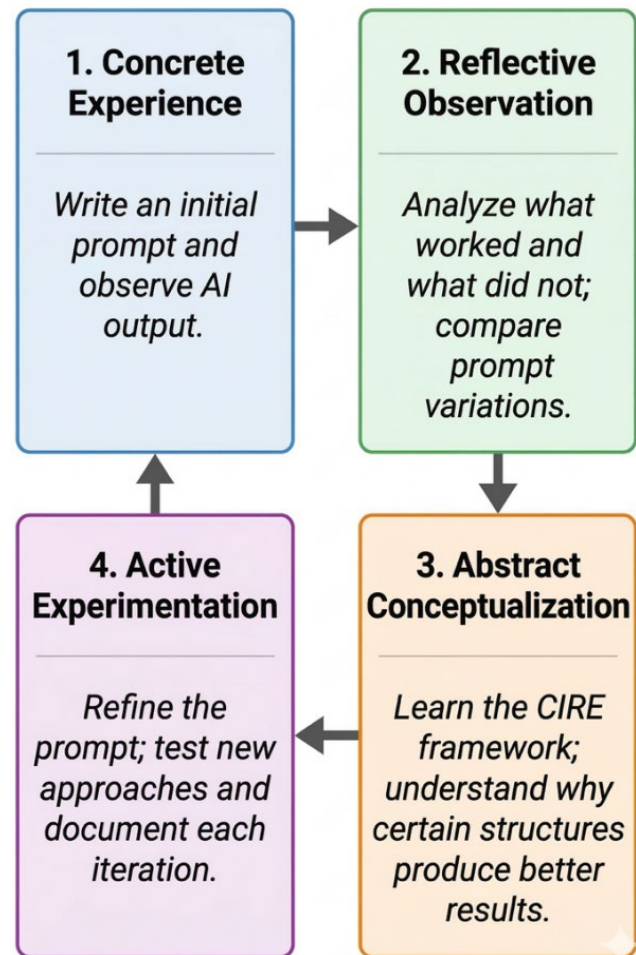


Figure 1. Kolb’s (1984) Experiential Learning Cycle applied to prompt engineering

Active learning principles (Felder & Brent, 2009; Prince, 2004) are embedded throughout the lesson design. Rather than passively receiving information about prompt engineering, students actively engage in hands-on experimentation, collaborative discussion, and reflective analysis. Bonwell and Eison (1991) identify key active learning characteristics particularly relevant here: student involvement in activities beyond listening, emphasis on developing skills rather than transmitting information, and engagement in higher-order thinking processes like analysis, synthesis, and evaluation. These characteristics align closely with the competencies required for effective prompt engineering practice.

The lesson employs backward design methodology (Wiggins & McTighe, 2005), starting with desired workplace outcomes (specifically, students who can effectively use AI tools for professional problem-solving), then systematically developing

assessments and learning activities to achieve these goals. This approach ensures that prompt engineering instruction directly connects to real-world applications and professional readiness.

ETHICAL CONSIDERATIONS

Ethical considerations are introduced alongside technical instruction, integrated throughout rather than treated as a separate topic. The instructor weaves ethical discussion into each phase of the lesson: during the opening discussion, students are asked to share examples of AI interactions that surprised or concerned them; during the framework presentation, the instructor explicitly names over-reliance, hallucinations, and bias as risks alongside each component; and during the lab, the instructor pauses the class at mid-point to briefly share a real example of an AI hallucination or biased output for group analysis. Students learn to recognize and address several key ethical concerns when working with generative AI.

Over-reliance on AI-generated content represents a significant risk, particularly in academic settings. Students learn to use AI as a tool for exploration, ideation, and assistance rather than as a replacement for their own thinking and learning. The portfolio assessment structure, requiring students to document their iterative refinement process, helps prevent simple copy-paste behavior and encourages critical engagement with AI outputs.

Hallucinations and false confidence pose risks when students accept AI outputs uncritically. The lesson emphasizes the importance of fact-checking, verification, and critical evaluation of all AI-generated content. Students practice identifying when AI responses contain errors, inconsistencies, or unsubstantiated claims. They learn to cross-reference AI outputs with authoritative sources and to recognize the limitations of AI knowledge, particularly regarding recent events, specialized domains, or factual accuracy.

Bias and hidden assumptions in AI outputs require careful attention. Students learn that AI systems reflect biases present in their training data and may perpetuate stereotypes, exclude perspectives, or make unwarranted assumptions. The lesson includes examples of how prompts can inadvertently reinforce biases or how AI outputs may contain problematic assumptions. Students practice identifying bias in

outputs and learn strategies for crafting prompts that mitigate bias or explicitly request diverse perspectives.

Academic integrity concerns are addressed directly, with clear guidelines about appropriate AI use in coursework. Students learn that using AI for brainstorming, clarification, or learning support is acceptable, while submitting AI-generated work as their own is not. The portfolio structure, requiring documentation of the prompt development process and reflection on limitations, helps ensure academic integrity while allowing productive AI use.

Privacy and data security considerations are introduced, particularly regarding what information students should and should not share with AI tools. Students learn about data retention policies, the importance of not sharing sensitive personal or institutional information, and considerations for using AI tools in professional contexts.

PRACTICE: INTRODUCTORY LAB

The introductory lab provides hands-on practice applying the prompt engineering framework to authentic problems. The lab is structured to guide students through the iterative refinement process while allowing flexibility for individual interests and professional contexts.

LAB SETUP AND PREPARATION

The instructor begins by distributing lab instructions and ensuring all students have access to a generative AI tool. Students are reminded to create accounts if needed and to verify they can access the tool. The instructor provides a brief demonstration of basic tool navigation, showing how to start a new conversation, how to reference previous messages, and how to copy outputs for documentation. Students are introduced to a structured document template they will use to document their work.

PROBLEM SELECTION

Students are instructed to select a problem relevant to their academic or professional interests. This industry-agnostic approach ensures authentic engagement while preventing academic dishonesty

through diverse problem selection. Examples might include a business student wanting to analyze market trends, a healthcare student seeking to understand patient communication strategies, an education student developing lesson plan ideas, or a data analytics student exploring data interpretation approaches. The instructor circulates to help students refine overly broad or vague problem statements into specific, actionable prompts.

INITIAL PROMPT DEVELOPMENT

Students write their first prompt using the framework components. The instructor provides a template structure:

- Context: [Define the role, background, and situation]
- Instructions: [Specify what the AI should do]
- Output Format: [Describe desired structure]
- Rules: [List constraints and requirements]
- Examples: [Optional - provide sample patterns]

Students capture their initial prompt and the AI's response, saving both in their working document. The instructor emphasizes that this first attempt is expected to be imperfect; the goal is to establish a baseline for comparison rather than to produce a polished result.

FIRST ITERATION AND REFLECTION

Students review their initial output and identify areas for improvement. Common issues include outputs that are too generic, missing specific details, formatted incorrectly, or not addressing the intended use case. Students revise their prompt, making specific changes to address identified issues. They capture the revised prompt and new output, documenting what changed and why. This process helps students understand the cause-and-effect relationship between prompt structure and output quality.

SECOND ITERATION AND COMPARISON

Students make a second round of refinements, further improving their prompts. They then create a comparative analysis documenting:

- What changed between iterations
- How outputs improved (or did not improve)
- What they learned about effective prompt structure
- Remaining limitations or areas for future improvement

REFLECTION AND DOCUMENTATION

Students write a brief reflection on the process, considering:

- What surprised them about prompt engineering
- How the framework helped structure their thinking
- Ethical concerns or limitations they noticed
- How they might apply this skill in their field

The instructor circulates throughout the lab to provide feedback, focusing on prompt clarity and reasoning rather than "right answers." In synchronous online sections, the instructor monitors student progress by requesting that students share their working document links in the chat, reviews submissions in real time, and provides feedback via direct message or brief breakout room check-ins. In asynchronous sections, the instructor reviews a mid-activity draft post before the final submission to provide timely guidance. This approach reinforces that prompt engineering is a skill requiring practice and iteration, not a set of correct formulas to memorize.

ASSESSMENT: GRADED HOMEWORK

The homework assignment extends the lab work into a comprehensive prompt engineering portfolio, submitted as a written document. This assessment evaluates both technical competency and critical thinking while ensuring academic integrity through individualized problem selection and documented process.

PORTFOLIO REQUIREMENTS

Students independently expand their lab work into a professional-quality portfolio demonstrating progressive skill development. Required components include:

PROBLEM STATEMENT AND CONTEXT (APPROXIMATELY 200 WORDS)

Students provide a clear description of the problem they are addressing, why it matters in their field, and what they hope to achieve. This establishes authenticity and helps students connect prompt engineering to real-world applications.

PROMPT ITERATIONS (MINIMUM OF THREE)

Students document at least three distinct prompt versions, showing progressive refinement. For each iteration, students must include:

- The complete prompt text
- The AI's output (or representative excerpt for long outputs)
- Explanation of what changed from the previous version and why
- Analysis of how the output improved (or did not improve) and what limitations remain

This requirement ensures students engage in genuine iterative refinement rather than simply trying three different prompts without learning from the process.

COMPARATIVE ANALYSIS (APPROXIMATELY 400 WORDS)

Students write a detailed comparison of their prompt iterations, analyzing:

- Which prompt components (context, instructions, format, rules) had the greatest impact on output quality
- Patterns they noticed about effective prompt structure
- Trade-offs between specificity and flexibility
- How different output formats affected usability

FINAL OPTIMIZED PROMPT

Students present their best prompt version with justification for why this version represents optimal balance between specificity, clarity, and effectiveness for their use case.

Reflection on Bias, Limitations, and Appropriate Use (approximately 300 words)

Students critically evaluate their AI interactions, considering:

- Any bias or problematic assumptions they noticed in outputs
- Limitations of AI for their specific problem domain
- When AI use would be appropriate versus inappropriate in their field
- How they would verify or validate AI outputs for professional use

PROFESSIONAL DOCUMENTATION

The portfolio must be professionally formatted as a single document with clear section headings, labeled prompt iterations, and a brief overview explaining the structure of the submission. This requirement develops professional skills while ensuring work is accessible for assessment.

ASSESSMENT CRITERIA

The portfolio is evaluated using a rubric, assessing:

- Technical Competency (40%): Quality of prompt structure, effective use of framework components, demonstration of iterative refinement
- Critical Analysis (30%): Depth of comparative analysis, identification of patterns and trade-offs, recognition of limitations
- Professional Documentation (20%): Organization, clarity, and completeness of the written submission, code/documentation quality, professional presentation
- Ethical Awareness (10%): Recognition of bias, understanding of limitations, appropriate use considerations

This assessment approach evaluates process over product, emphasizing reasoning, refinement, and transparency. Because each student selects their own domain and problem, responses are inherently original, reducing opportunities for academic dishonesty while encouraging authentic exploration of personally relevant applications.

SUBMISSION AND FEEDBACK

Students submit their completed document through the learning management system. The instructor reviews portfolios, providing detailed feedback on

prompt engineering technique, analytical depth, and professional presentation. Research supports the value of instructor feedback in AI-integrated learning environments as a mechanism for improving student outcomes and reinforcing critical engagement (Hooda, 2022). Common feedback themes include suggestions for more specific context, clearer instructions, better output formatting, or deeper analysis of limitations. This feedback supports continued skill development while recognizing effective practices.

CRITICAL REFLECTION

This learning representation has been implemented three times in undergraduate courses, with class sizes ranging from 10 to 15 students. Implementations have included asynchronous online, synchronous online, and in-person formats; the instructional framework and assessment structure remain consistent across all three. Across implementations, students demonstrated increased intentionality in prompt construction, greater awareness of ethical considerations, and improved ability to articulate how iterative refinement influenced AI outputs.

This lesson has proven highly effective in reframing how students view generative AI, transforming their understanding from seeing AI as a shortcut or magic solution to recognizing it as a tool requiring skillful, intentional interaction. The structured framework provides students with a systematic approach they can apply across diverse contexts, building confidence and competence in AI interaction.

Students consistently report increased confidence using AI responsibly and demonstrate improved ability to troubleshoot unclear outputs, ask more precise questions, and critically evaluate AI-generated information. The hands-on lab component generates high engagement, with students actively experimenting and sharing discoveries with peers. The portfolio assessment structure, requiring documented iteration and reflection, ensures students engage deeply with the material rather than superficially completing assignments.

The industry-agnostic approach, allowing students to select problems relevant to their fields, produces authentic engagement and meaningful learning. Business students develop prompts for market

analysis, healthcare students explore patient communication strategies, education students create lesson planning assistants, and data analytics students build data interpretation tools. This diversity enriches class discussions as students share insights across domains while ensuring all students develop core competencies regardless of their specific applications.

Several implementation challenges emerged during initial iterations, each addressed through course refinement. Some students initially struggled with the abstract nature of prompt engineering, finding it difficult to understand how small prompt changes could significantly impact outputs. This challenge was addressed by providing more concrete examples and demonstrations, showing side-by-side comparisons of prompt variations and their resulting outputs. The lab structure, with guided iteration steps, also helped students experience the cause-and-effect relationships directly.

Time management proved challenging for some students, particularly those less familiar with structured written documentation and iterative revision practices. The solution involved scaffolding the assignment through a pre-formatted document template and staged submission expectations, reducing cognitive load while reinforcing the iterative nature of prompt engineering. Some students also needed guidance on selecting appropriately scoped problems: those that were too broad produced overwhelming outputs, while those too narrow limited learning opportunities. The instructor now provides clearer problem selection guidelines and examples of well-scoped problems.

Academic integrity concerns required careful attention, particularly ensuring students were not simply copying AI outputs without engagement. The portfolio structure, requiring documented iteration and reflection, addresses this by making the learning process visible and assessable. The requirement for students to explain changes between iterations and analyze limitations ensures genuine engagement with the material.

A key instructional insight is that teaching prompt engineering early in the course significantly reduces downstream confusion in later AI, ML, and analytics topics. Students who master prompt engineering can independently troubleshoot AI outputs, seek clarification on complex concepts, and use AI tools effectively for learning support throughout the

course. This foundational skill enables more advanced learning by providing students with self-directed problem-solving capabilities.

The integration of ethical considerations throughout technical instruction, rather than as a separate unit, proves more effective. Students naturally encounter ethical questions during hands-on practice (noticing bias in outputs, recognizing limitations, or questioning appropriate use), making ethical reasoning feel relevant and practical rather than abstract or disconnected from technical skills.

The backward design approach, starting with professional readiness outcomes, ensures the lesson remains focused on transferable skills applicable beyond the classroom. Students consistently report that prompt engineering skills transfer to professional contexts, with many using these techniques in internships, work projects, or other courses.

Several potential modifications could enhance the lesson further. A future extension could introduce AI-generated study aids (e.g., summaries or podcasts) using the same prompting framework, demonstrating additional applications while reinforcing framework principles. This extension would be optional, allowing instructors to adapt based on course goals and time constraints.

The lesson could be expanded to include more advanced techniques like chain-of-thought prompting, few-shot learning with multiple examples, or prompt chaining for complex multi-step tasks. However, the current scope appropriately focuses on foundational skills accessible to diverse student backgrounds.

For institutions with different student populations or course structures, the lesson can be adapted while maintaining core principles. The framework remains applicable whether delivered in-person, online, or in hybrid formats. The industry-agnostic problem selection approach accommodates any discipline or professional context. The assessment structure can be modified to fit different grading schemes or course requirements while preserving emphasis on process, iteration, and reflection.

The lesson's effectiveness depends on students having reliable access to generative AI tools, which may present challenges in regions with restricted access or for students with limited internet

connectivity. Instructors should have backup plans and alternative tools available. The free-tier limitations of some AI tools may restrict usage volume, requiring students to be strategic about their interactions.

The rapid evolution of AI technology means that specific tool interfaces and capabilities change frequently. The lesson focuses on transferable principles rather than tool-specific instructions, but instructors must stay current with tool updates and be prepared to adapt examples and demonstrations accordingly.

Assessment workload can be substantial, given the detailed portfolio review required. Instructors should plan adequate time for providing meaningful feedback on student work. The portfolio structure, while ensuring academic integrity and deep engagement, requires more assessment time than traditional assignments.

This lesson successfully addresses the critical need for structured AI literacy education in undergraduate programs. By treating prompt engineering as a foundational, teachable skill grounded in established learning theories, the lesson prepares students for effective, ethical AI interaction across diverse contexts. The combination of structured framework, hands-on practice, and reflective assessment creates learning experiences that transfer beyond the classroom to professional applications. The lesson demonstrates that generative AI can be integrated into undergraduate instruction in ways that promote transparency, ethical use, and transferable problem-solving skills without requiring extensive technical prerequisites or additional instructional overhead.

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ABOUT THE AUTHOR

Scott Turner is an adjunct faculty member in the School of Professional and Continuing Studies at the University of Richmond, where he teaches undergraduate courses in artificial intelligence and data analytics. He is an active AI practitioner, working professionally in applied artificial intelligence and machine learning.

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