STUDENT LEARNING GOALS

- Appreciate the importance of providing an environment that fosters creativity in the early childhood classroom.
- Distinguish between growth and fixed mindsets.
- Synthesize information about STEAM, creative confidence, and mindsets by inventing with different types of materials and tools.

Materials List

General

- Computer with internet access/speakers
- PowerPoint slides for Session 16 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- Big Ideas of Early Mathematics textbook

For the Science Focus

- Invention Center exemplar activity guide
- Recommended: Not a Box by Antoinette Portis
- Optional: extra materials for inventing, extra tools such as hole punchers, scissors, staplers, and tape.
- Students provide: Assorted materials from “Items to Bring for Invention Center Exemplar” handout (recyclables, connectors & tools, craft supplies etc.)
### Session at a Glance

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<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Estimated Time (In Minutes)</th>
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<tr>
<td>Arrival Activity</td>
<td>Students view images that can be imagined to be many different things depending on how you interpret them. This exercise emphasizes flexible and innovative thinking and sets the tone for the Invention Center exemplar activity.</td>
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<tr>
<td>Welcome, Agenda, and Announcements</td>
<td>Give a general overview of the session and any relevant announcements, and provide time for sharing.</td>
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<tr>
<td>Discussion: Integrating Art with STEM/Promoting Creative Confidence and a Growth Mindset</td>
<td>Students explore the relationship of Art to STEM. They reflect on their self-identity as a creative person and discuss the importance of providing an environment that fosters creativity and a growth mindset in the early childhood classroom. They read a poem and watch a video to deepen their understanding of these ideas.</td>
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<tr>
<td>Science (STEAM) Focus: Invention Center</td>
<td>Students participate in the exemplar activity: Invention Center. They engage in an open-ended design process to invent imaginative creations. They reflect on how these kinds of creative experiences help children to learn about the properties of materials and how everyday materials can be utilized in innovative ways.</td>
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<tr>
<td>Looking Ahead to Next Session</td>
<td>Wrap up with reminders about the Final Assignment and any other announcements about the end of the course.</td>
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**Total Estimated Time:** 2 hr 30 min

### Before Session

- Review the materials relevant to this session
  - Exemplar activity guide: Invention Center
  - PowerPoint for Session 16 (downloaded from website)
  - Reader Section: Session 16
  - Video: David Kelley: Creative Confidence: [http://www.designkit.org/mindsets/3](http://www.designkit.org/mindsets/3)
- Make copies of any printables and/or handouts.
- Set Up Materials
  - Think about how to optimize space for the Invention Center activity. This activity works best when the materials the students brought can be spread out on tables/counter space and on floor areas (for the larger materials) where everyone can easily access them versus placing them on the tables where students sit. Alternatively, you might consider using another space such as a hallway, adjacent classroom, or Lab School, if your college has one.
  - Students will be bringing a lot of materials so you will need a plan for organizing them. It is very helpful to designate areas for each type of material – recyclables, connectors & tools, and craft supplies – and to make signs so students know where to place their items when they arrive for class.

### As Students Arrive

- Have students sign in on attendance sheet and mark if they brought their materials for Invention Center to class.
- Direct students to put their materials for inventing in the designated areas.
- Have students turn in their homework.
Arrival Activity: This is a fun exercise to set the tone for the Invention Center exemplar activity that uses flexible and creative thinking: Choose one of the images to look at. What could it be (or be part of)? Look at it from as many different points of view as you can. Use your imagination freely. Share your ideas with each other.

1. Announcements and sharing.
   • If you have students who are working with children ask if anyone tried any of the science and math activities from the course and to share their observations and insights. Ask if anyone has other relevant news or anecdotes to share.
   • Share any observations, clarifications, or notable comments that you feel should be mentioned related to the previous session’s homework or the Final Assignment, which is due next session.

2. Review Agenda

Early Childhood Topic

3. Explore the relationship of Art to STEM.
   • Review the acronym STEM (Science, Technology, Engineering, Math).
   • Ask if anyone has heard of STEAM. STEAM includes Art and Design within STEM. Ask students why they think there is a movement to add Art to STEM.
   • Explain that proponents of the STEAM movement argue that:
     o Art involves creativity, design, problem solving, innovation, and critical thinking skills that are inextricably linked to STEM.
     o Art provides more ways for teachers to work STEM concepts into the curriculum.
     o Children can use creative and artistic modes to express STEM concepts.
   • Point out that although some people argue over STEM vs. STEAM, early childhood has always approached curriculum in a very integrated way, so the idea is not really new to us.

4. Discuss the importance of providing an environment that fosters creativity.
   • Have students read the classic poem by Helen E. Buckley, “The Little Boy” in their Course Readers.
   • After reflecting on the poem, ask students if they have experienced anything similar. Encourage them to talk about whether they consider themselves creative and what that means to them.
   • Note that creativity is not just what artists are good at. Everyone is creative. Creativity is what leads to new inventions and ways of doing things.
• Watch the video about Creative Confidence. David Kelley, Stanford professor and author of the book Creative Confidence: Unleashing the Creative Potential Within Us All explains that creativity is a way of approaching the world.

• After watching the video, ask students for their reactions to David Kelly’s message about creativity. Ask, “How does creative confidence relate to how we teach young children?” Emphasize that the most powerful way to provide an environment that fosters creativity is to be a role model for creative thinking. It is critical that as teachers, we show our own enthusiasm for learning new things. When teachers display curiosity and creativity and value these same dispositions in children, these are likely to flourish in the classroom.

5. Introduce the idea of Growth and Fixed Mindsets.
• Explain that one of the best ways teachers can help children become creative thinkers and problem solvers is to help them develop a “growth mindset.” Carol Dweck, a professor at Stanford University coined the terms fixed and growth mindset in her book Mindset (2006).

• Show the slide “What Kind of Mindset Do You Have?” This handout is in their Course Reader. In a growth mindset, people believe that their most basic abilities can be developed through dedication, hard work, and help from others. A fixed mindset believes that ability and talent are innate.

• Have students turn and talk with a partner about how they see themselves in terms of fixed and growth mindsets. As an example, share some of your own personal examples. Relay a time when you failed at first, but through persevering, overcoming frustration, and not giving up, you eventually became better at the task at hand. It could be anything – from learning another language or computer skill to learning a new sports skill.

• After students have had enough time to share with each other, sum up by acknowledging that most of us can relate to both mindsets, depending on the context. Emphasize that in all areas of our lives, through practice and hard work, we can learn new things, develop our creativity, and physically rewire our brains. Everyone is creative!

6. Introduce the Invention Center exemplar activity.
• Introduce the Invention Center as an area in the classroom for creating and innovating. Explain that the Invention Center is not a one-time experience. Rather, materials are organized and kept in the classroom for an extended period of time so that children have multiple opportunities to invent and work on projects overtime.

• Underscore that the Invention Center offers opportunities for teachers to nurture creative confidence and a growth mindset.
• Tell students that you will model the *Engage* part of the exemplar in much the same way you would do it with children. This is a purposeful way to help them experience the activity through a child’s eyes and to demonstrate how a teacher might engage and guide children.

7. Read *Not A Box* by Antoinette Portis.

• As you read the story, encourage students to wonder about what the box might become before flipping the page to show the author’s version. Welcome all of their ideas. By doing this, you are inviting them to use their own imaginations and to think creatively.

• **Instructor Note:** If you do not have the book, you can watch and listen to it being read through the following YouTube link: [https://www.youtube.com/watch?v=3KXuBcdmktY](https://www.youtube.com/watch?v=3KXuBcdmktY)

• After reading the story, tell students that just like the rabbit in the story, they are going to be inventors too.

**Engage**

• Ask students what it means to be an inventor.

• Explain that an inventor is someone who invents, designs, and builds things for a certain purpose. Someone invented and designed everything around us! Discuss some examples from the classroom such as a chair, easel, paper clip, or other everyday objects. Point out how each item is used for a specific purpose or to help people do a certain job.

• Tell the students that they will be using the materials they brought to make inventions. Show examples of some of the different materials students brought to class or ask students to show some of the things they brought to share.

• Choose a recycled item, such as a paper tube, to hold up as an example. Discuss what the item is and where it came from, and then encourage students to brainstorm all of the things it could become!
  
  o **Example:** Paper tube
  
  o Say, “What is this?” (A paper towel tube). “I don’t need it for paper towels anymore, so what could it become now?”
  
  o Students might suggest things like a flag, a telescope, a fire hose, a musical instrument, etc. Note: You might want to pass the tube around from student to student as they think of ideas.

• Identify what tools are available (scissors, hole punchers, staplers, tape) and other materials that are helpful for connecting parts (paper fasteners, pipe cleaners, etc.)

• Suggest that before students start creating, they take a look at all of the different materials to become familiar with what is available. Emphasize the importance of giving children plenty of time to freely explore the materials before expecting them to use them in a purposeful way.
Explore

• Share a quote from Thomas Edison for inspiration, “To invent you need a good imagination and a pile of junk.”
• Give students the following guidelines:
  o Create individually or with others.
  o Even if you do not know how it will turn out, start making it. Along the way you will encounter lots of problems that you will overcome and you will get new ideas.
  o This is an open-ended activity. There is no right way to do it. Use your imagination.
  o You do not have to make something, but try out possibilities.
  o Everyone approaches it differently – Have a growth mindset!
• Let them know how much time they have for making their inventions.
• Instructor Note: As the activity time comes to an end, give them 10 and 5-minute “warnings” to let them know how much time is left. Be sure to reserve time for sharing and reflecting.

It is recommended that the instructor do some inventing along with the students. It is important to role model your own creative spirit. By sharing in this experience with your students, you demonstrate the value of engaging in this kind of activity as an adult learner.

Reflect

• If space allows, have the class stand in a circle. Ask them to bring their inventions with them, if they want. Acknowledge that their inventions may still be works-in-progress and that’s okay.
• Ask students to share about their experience. Some questions you might ask are:
  o What materials were you drawn to?
  o How did you come up with your idea?
  o What did you try to do? What problems did you have to solve?
  o What did you learn about yourself during this activity?

Clean up: Direct students to clean up their materials. If there are not sufficient recycling bins available, have students take their materials back home with them.

8. Show photos of children working at the Invention Center. Ask for students’ ideas on modifications for different ages and developmental levels.

9. Focus students on thinking about properties of materials.
• Explain that when children make their own inventions, they are not only being creative, but are also involved in learning about the properties of different materials, which is a key aspect of engineering. With practice, they begin to develop the skills to choose the best materials for certain tasks and purposes.
• Ask students to brainstorm what they learned about the properties of some of the materials they used today. For example: which ones were: bendable, stretchy, transparent, absorbent, tough (difficult to break), shiny, waterproof, etc. These kinds of experiences help children learn that certain materials have properties that are appropriate for specific uses and also that while some materials might be reasonable for a certain use, others might do the job better.

• Show slide of how inventing helps children develop life skills. Ask, “Which of these skills did you practice while you were inventing?”
  - creativity
  - imagination
  - engineering & physics skills
  - problem solving skills
  - fine motor skills
  - visual spatial skills

Wrapping Up

10. Looking ahead to next session.
• Mention that the Course Reader (Session 16) contains a handout called “Trying New Ideas Leads to Better Solutions.” Although no homework is assigned this session, the handout is recommended reading because it is relevant to ideas explored in today’s class about creativity, inventing, and engineering.
• Wrap up with reminders about the Final Assignment and any other announcements you have to make about the end of the course.
• Note: Session 17, the final class, is intentionally left open-ended so that each instructor can wrap up the course as they choose. Some ideas for the final session can be found in the (shortened) Session 17 Instructor Guide.