



Make Way for Ducklings:

An Integrated Engineering and Empathy Challenge

Activity Summary: In this design challenge inspired by the classic Boston-based children's book, *Make Way for Ducklings* by Robert McCloskey, students are introduced to empathy and engineering as they design something to help a family of ducks cross a busy road.

Enduring Understanding: Using empathy helps engineers better collaborate with all those involved in the project (people, communities, animals, etc.) to design more effective solutions.

Essential Questions:

- How can you think about the needs and perspectives of others when making something to help them?
- How can you create a way to keep the ducks safe as they cross the road?

Objectives:

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

- Work collaboratively to design and discuss a solution to help the ducks feel safe as they cross the busy road.
- Take the perspective of the ducks, commuters, and local people involved in the situation.

Timing: We recommend this activity be implemented over at least 75 minutes, but it should be split up and taught in whatever way is best for you and your students.

Standards:**Guidelines for Preschool and Kindergarten Learning Experiences (MA DESE and EEC) v. 2019****Social and Emotional Learning**

- SEL1. The child will be able to recognize, identify, and express his/her emotions.
- SEL5. The child will display empathetic characteristics.
- SEL8. The child will engage socially, and build relationships with other children and with adults.

Approaches to Play and Learning

- APL3. The child will be able to maintain focus and attention, and persist in efforts to complete a task.
- APL4. The child will demonstrate creativity in thinking and use of materials.
- APL5. The child will cooperate with others in play and learning.
- APL6. The child will seek multiple solutions to a question, task, or problem.

English Language Arts and Literacy

- PK.RL.1 (MA). With prompting and support, ask and answer questions about a story or poems read aloud.
- PK.RL.9. With prompting and support, make connections between a story or poem and one's own experiences.
- K.SL.2. Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.

Next Generation Science Standards

- K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
- K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
- K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Massachusetts Science and Technology/Engineering Curriculum Framework

- PreK-ESS2-1(MA). Raise questions and engage in discussions about how different types of local environments (including water) provide homes for different kinds of living things.
- PreK-ESS3-2(MA). Observe and discuss the impact of people’s activities on the local environment.
- PreK-LS2-2(MA). Using evidence from the local environment, explain how familiar plants and animals meet their needs where they live.
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment.

Materials and Preparation

For the Educator	Recommended For Each Pair of Students
<ul style="list-style-type: none"> ● <i>Make Way for Ducklings</i>, by Robert McCloskey, book or specific images from the story to project (if you plan to shorten the text) ● Your classrooms’ standard “city” themed learning centers (or recommended learning centers in Appendix 1) ● Optional: Camera ● Optional: Projector and speaker (if you would like to use the videos and images listed throughout the lesson) 	<ul style="list-style-type: none"> ● 1 car/truck at least 3-4 inches tall ● 1 piece of yarn or string (24”) ● 1 road image ● 1 rubber duck (small) ● 2 manilla folders ● 2 pairs of scissors (child-sized) ● 4 sheets of construction paper ● 4 sheets of copy paper ● 4 toilet paper tubes ● 6 paper cups ● 10 craft sticks ● 10 paper clips ● 10 pieces of tape ● 10 pipe cleaners <p>Note: Set aside additional amounts of all of these materials in case students need more supplies for improving their designs.</p>

Tips


- We recommend having students work in pairs. Two sets of hands and minds can help students complete the challenge, while also nurturing children’s empathetic thinking - students working together need to practice taking the perspective of one another.

Before the Activity

- Consider student pairings that would be most successful in your classroom.
- Prepare a bowl or tray for each pair of students with the materials, setting aside additional materials for students who need more later on.

- Prepare pieces of tape so they are ready for students to use during the design challenge. They can be placed on the edges of tables or on the trays/bowls.
- Optional: If projecting images or using any of the videos, set up a projector and speakers.
 - A video of traffic noise, such as “Heavy Traffic Jam Sound Effect #1 | Sound Of Traffic Jam or Traffic Noise,” by Sound Effect <https://tinyurl.com/teutr9k>
 - Images of animal crossings, such as the article, “7 Animal Crossing Around the World,” by Michele Debczak <https://tinyurl.com/qt5oa6q>
 - A video of people helping ducks cross the road, such as in the video “Saving a duck family crossing a busy street in Cologne,” by Jan Knoff Video (the first 35 seconds): <https://tinyurl.com/srlq82e>



Note: Throughout the lesson, there are boxes with a thought bubble  in them. These boxes share the rationale behind certain elements of the lesson and indicate where you might want to differentiate the lesson for your students.

Vocabulary:

- Challenge
- Community
- Cross
- Design
- Empathy
- Engineer
- Mallard
- Materials
- Molt
- Public
- Waddle
- Wade

Activity

Thinking About Cities (can be done over multiple days)

1. Ahead of time, set up city-focused learning centers for your students, so they can start thinking deeply about the people, places, and things that make up cities. If you don't typically study cities at centers, here are a few suggestions:
 - Provide books about cities and professions in your class library or reading nook
 - Introduce cars and trucks to your pretend play area
 - Put out maps and pictures of city buildings at a table for students to investigate
 - Arrange tools and materials for creating city-themed art at the art table

- Highlight different examples of urban wildlife during science—bugs, raccoons, squirrels, birds, snakes, etc.
- See the Appendix on page 13 for more detailed suggestions



If centers are not a norm in your classroom, consider taking your students out on an exploration of your school's neighborhood. Make observations about who and what you see. Ask students about their favorite parts of your neighborhood or city. Read some of the books listed above and have discussions about the people, places, and things in cities.

2. Exploring these centers can help students develop an understanding that:
 - People and animals live in cities.
 - Roads, buildings, parks, schools, cars, trains, and sidewalks are all important things that make up a city.
 - There are many different people who live in cities who have different jobs.
 - People who live in cities work together to make sure that their **community** is safe for everyone, including animals.
3. After your students have had plenty of time to explore the centers, perhaps over a few days, bring them together to recap their experience learning about cities. Ask students,
 - Who lives in cities?
 - What animals live in cities?
 - What kinds of jobs do people have in cities?
 - How do people move around in cities?
 - What are some important places in cities?
 - *Possible responses: schools, parks, hospitals, grocery stores, etc.*

Introduction

1. Read *Make Way for Ducklings* with students. The book is fairly long, so it might be best to split the reading over a few sessions or to paraphrase some portions of the text.
2. After reading the story, review certain aspects to introduce the **challenge** they will be working on.

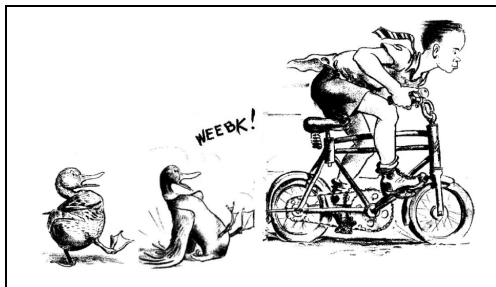


To encourage students to consider empathy as they engage in the design challenge, we recommend asking questions as parts of the story are reviewed. These questions are intended to encourage students to think about the feelings of the characters in the story, relating some of these experiences to their own lives, and how they may have felt in similar situations. Encourage students to explain what they see in the book illustrations to support their responses.

- Review the pages where Mr. and Mrs. **Mallard** are flying over the Boston **Public** Garden. Remind students that the ducks are looking for a new home.



- Turn to the pages with a boy on a bicycle. Tell students that when Mr. and Mrs. Mallard arrive at the Garden, they are almost hit by a boy traveling by on a bicycle.



Ask students:

- Has a bike ever rushed by close to you? How did you feel?
- How do you think Mr. and Mrs. Mallard feel right now? Why do you think that?

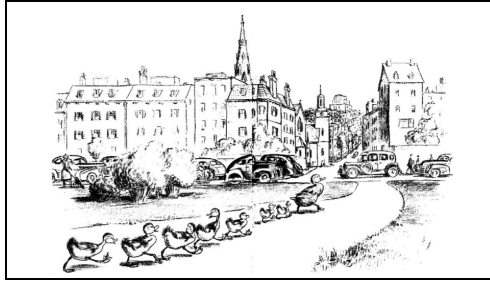
- Tell students that after this scare, Mr. and Mrs. Mallard end up swimming to a park on the Charles River, where they meet Michael, the policeman who likes to feed them. Show students the pages where Michael the policeman is feeding the ducks.



Ask students:

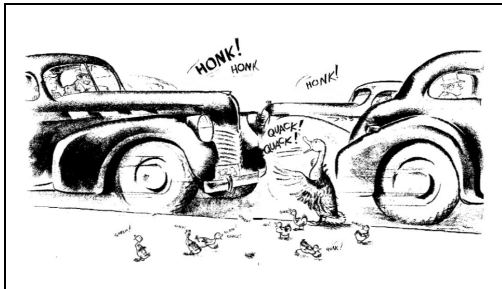
- How do you think Mr. and Mrs. Mallard feel in this new spot?
- How do you think Mr. and Mrs. Mallard feel about Michael? How can you tell?
- How do you think Michael feels about the ducks? Why?

- Remind students that Mr. and Mrs. Mallard now have eight ducklings and they decide to take a walk back to the Public Garden. Show students the pages where Mrs. Mallard and her ducklings are walking towards a road.



If you think it would be appropriate for your students, when looking at the next pages play a video of traffic noises to give students a deeper sensory experience. Engaging the senses can be an important part of supporting students in taking the perspective of others.

- Turn to the pages where Mrs. Mallard is trying to **cross** a road full of fast-moving cars with her ducklings. Tell students that Mrs. Mallard and her ducklings are having a hard time crossing the road.



Ask students:

- Have you crossed a busy road before? How did you feel?
- How do you think Mrs. Mallard feels?
- How do you think the ducklings feel?
- How might the drivers feel?

3. Tell students that throughout the review of the book, you asked questions to help them imagine and describe the emotions of the ducks and people in the story. Being able to imagine and understand the emotions of someone else is called **empathy**. They will need to keep thinking about how others might be feeling as they go into the next activity.

Design Challenge

1. Explain to students that in the story, crossing the road is a big problem for Mrs. Mallard and her ducklings.

Ask students:

- Does anyone walk to school?
- Have you ever had to cross a busy road?
- What is it like when you cross a busy road? How do you feel? Do you feel safe?

2. Tell students that for some people and animals, crossing busy roads with a lot of cars can be scary. Ask students if there are any things they know that help them cross roads.
 - If students do not mention any of the following, you might want to share examples such as crosswalks, traffic lights, and bridges.
3. Let students know that their challenge is to make something to help Mrs. Mallard and her ducklings get across the road safely.
4. Have the class brainstorm some ideas together about what they might make. Ask students if they have seen or heard of ways to help animals cross roads safely.



You may want to show students examples of animal crossings, such as the ones in the article, *7 Animal Crossings Around the World*, on mentalfloss.com (<https://tinyurl.com/qt5oa6q>). If there are any animal crossings in your area, consider showing students images to help give them a sense for how they might approach making a design.

5. Explain to students that as they are making a way for Mrs. Mallard and her ducklings to safely cross the road, they will be acting like engineers. **Engineers** are people who make things that solve problems for people and animals.
6. Have students look all around them. The pencils, desks, chairs, books, windows, and many other things in their classroom that help them learn were made by engineers.
7. Tell students that in this challenge, there are three things they need to keep in mind as they work:
 - You will make a way for the ducks to get from one grassy side of the road to the other safely.
 - Cars, trucks, and people must be able to travel freely on the road.
 - You can use any of the **materials** you are given and can ask for additional materials if you need them.



If you would like to add a time constraint as part of this challenge, we recommend giving students at least 20-30 minutes. However, you might want to split up the time by having students come back to their designs over a few sessions.

8. Tell students that as engineers solving this problem, they will have to think about the ducks and the people who live in the city and use the road.
9. If students will be working in pairs, ask them what they think they need to do to be a good teammate. This could include listening, making sure everyone is helping, respecting each other and their ideas, sharing the materials, etc.

10. If you think it is helpful, you may want to introduce the engineering design process to your students (see the graphic included in the front matter, or share any engineering design process commonly used in your school or district).
11. Review the materials that students will be able to use. Give each group a duck, a road, a car or truck, and a set of materials.
12. Have students start engineering their **designs**. Circulate among the group and talk to students about their designs as they are working. If you have decided to add a time constraint, give students regular time checks.
 - Potential prompts include:
 - Tell me about the materials you chose to use.
 - How did you decide on what you are making?
 - How will you know if your design works for the ducks and the cars?
 - How do you think the ducks would feel crossing the street using what you made?

Testing and Reflection



We recommend taking some time to reflect on students' work to wrap up the activity. This will help students connect back to the story, think about how they felt making something for the ducks, and consider how the ducks and people would feel knowing these designs have been engineered for them.

There are various formats in which this can be done. You should decide on a format that is most appropriate for your students. We recommend having students step away from their designs during any share out time so they are not tempted to continue working on their design.

Option 1 (recommended for early PreK)

- When students are ready or time is up, have students put down their materials and step away from their designs. You may also choose to have students demonstrate their design for you.
- Debrief the challenge as a full group. Ask students:
 - How does your design keep the ducks safe?
 - How do you think the ducks would feel using what you made to cross the road?
 - How did you feel about making something to help the ducks cross the road?

- What was it like working in a team? How do you think your teammate(s) felt working with you? Why do you think so?
 - Tell students that many engineers work in teams just like they did and it takes practice, even for grown-up engineers!

Option 2 (recommended for PreK or early Kindergarten)

- Tell students that they will have a few minutes to walk around (just looking, no touching!) and look at the designs the other students made.
- You may also choose to have students demonstrate their design for you.
- Debrief the challenge together. Ask students:
 - Tell us about what you made.
 - What did you make so the ducks would feel safe?
 - How do you think the ducks would feel using what you made to cross the road?
 - How did you feel about making something to help the ducks cross the road?
 - What was it like working in a team? How do you think your teammate(s) felt working with you? Why do you think so?
 - Tell students that many engineers work in teams just like they did and it takes practice, even for grown-up engineers!

Option 3 (recommended for Kindergarten)

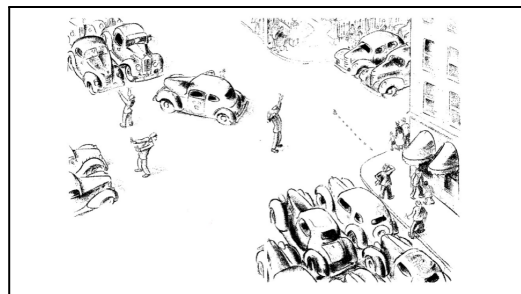
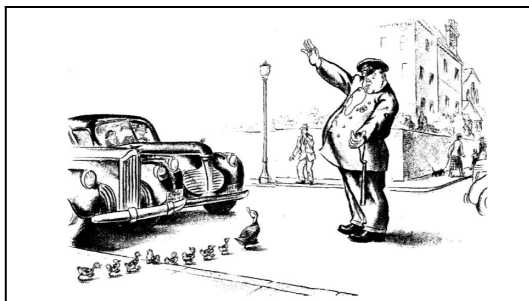
- Debrief the challenge together. Ask students:
 - Tell us about what you made.
 - How does your design keep the ducks safe?
 - If you had more time to do this again (or more materials), what would you do differently?
 - How do you think the ducks would feel using what you made to cross the road?
 - How did you feel about making something to help the ducks cross the road?
 - What was it like working in a team? How do you think your teammate(s) felt working with you? Why do you think so?
 - Tell students that many engineers work in teams just like they did and it takes practice, even for grown-up engineers!

- Tell students that they will have a few minutes to walk around (just looking, no touching!) and look at the designs the other students made. You might want to encourage them to see what is similar or different about the designs. You may also choose to have students demonstrate their design for you or others in the class.
- After students have looked at all the designs, have students gather together once again in one area of the room. Invite them to share one thing they liked about another design.
- Point out if there are common elements of the various designs or anything that stands out.



Common elements could mean that students were thinking about the properties of the materials or thinking about the needs of the ducks and the drivers. They could have found that a certain material seemed to work really well to meet their needs. Unique elements could show students creatively thinking of different ways to use a common material or demonstrate there are a lot of ways to solve a problem.

1. If any students were struggling to create a successful design, let them know that it is ok if what they made did not come out exactly like they were thinking. With more time and materials, they would be able to make something that works well. There is always something good about what they made!
 - Optional: If you would like, set up an area in the classroom where students can continue to work on their designs or try new ideas.
2. Ask if students remember how this problem was solved in the story. Show students the pages where Michael and some other police officers stop the cars so the ducks can safely cross the road. Sometimes people's actions might be part of the solution to a certain problem. Engineers also can think about this as they work with others to solve problems.



- Optional: Show the first 34 seconds of the video (<https://tinyurl.com/srlq82e>) where people are helping some ducks cross the road.
3. Congratulate students on being engineers!

Ask students:

- How do you think Mrs. Mallard and her ducklings might feel knowing that there are engineers working to design a safe way for them to cross the road?

Appendix

Centers Set-Up

Activity	Set-Up	Prompts	Learning Objectives
<p>Picture books about cities and city life</p>	<p>In your reading corner, or classroom library, include some city-themed books.</p> <p>Some suggestions:</p> <ul style="list-style-type: none"> ● Last Stop on Market Street, Matt de la Peña ● Tar Beach, Faith Ringgold ● Knuffle Bunny, Mo Williams ● A Pocket for Corduroy, Don Freeman ● City Shapes, Diana Murray ● Maybe Something Beautiful, Isabel Campoy and Theresa Howell ● The Curious Garden, Peter Brown ● Maybe I Can Love My Neighbor Too, Jennifer Grant ● Tap Tap Boom Boom, Elizabeth Bluemle 	<p>What are the characters doing?</p> <p>What places in the city are important?</p> <p>How do the characters move around in the city?</p> <p>How do the characters help each other?</p>	<p>Many different people and animals live in cities.</p> <p>People living in cities work together as a community to solve problems and stay safe.</p> <p>There are many different important places in cities.</p> <p>There are many different forms of transportation in cities.</p>
<p>Exploring maps</p>	<p>Put out maps and pictures of your city or town on a table. Highlight the location of your school. Let children explore the maps, either open endedly or encourage them to look for specific things (e.g. a park, a pond or river, a school, a long street, a train station, etc).</p>	<p>What do you notice about our city/town?</p> <p>“I spy.....” (a road, a river, a school, a park, etc)</p>	<p>There are lots of roads in cities and towns.</p> <p>There are parks in cities and towns.</p> <p>Sometimes parks and roads are very close to each other.</p>

Pretend play	Put out trucks, cars, and trains in your pretend play or blocks area. You may also choose to put out some animals as well. Let the children play and explore the toys.	How do people get from place to place in a city?	There are many ways to move around a city: cars, trains, walking, etc.
Building a city	Give students cardboard boxes and markers. Encourage them to create buildings, then arrange the buildings together as a little city.	What buildings does our city need to have? How do people travel around our city?	There are many different buildings and places in a city. There are different ways to travel around a city.
Drawing a city	Set up a big piece of paper. Have students draw roads, buildings, and other elements to make a city. Another art-based idea is to use pre-cut shapes and glue, like in this activity, <i>What Can We Do with Paper and Glue</i> : tinyurl.com/3mkem943 .	What should we have in our city? Who lives in our city? How do people get from place to place in our city? Where do animals live in our city?	Cities have roads, buildings, and natural features.
Urban wildlife	Print out and display images of common animals found in cities near where your school is located (some are listed here: tinyurl.com/38wn48tv). Make sure to include ducks! You can also include some picture books about these animals or any animal reference books.	What animals have you seen before in our city/town? How do you feel about these animals living in our neighborhood?	Many different animals live in a city.