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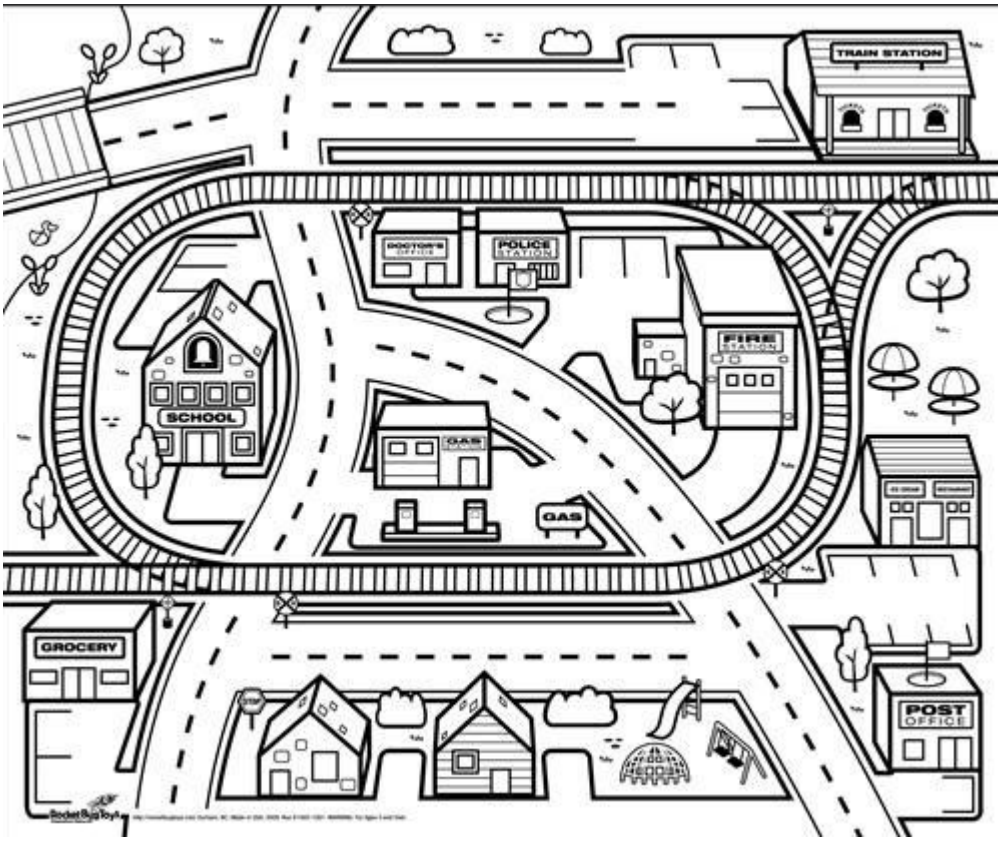
LESSON PLANS



Contents

CHALLENGE 1 – WHAT'S IN MY COMMUNITY?

Help students understand how the buildings and other structures in a community help the people who live there.

1. Get prepared:

* If you are using the ***Engineer's Notebook*** template, print, collate and staple the sheets of paper.

* Go through **magazines** and tear out pages that show trees, buildings, streetlights, and other items that may be seen in a community. Have these sheets ready for later.

2. Ask students for a good definition of a community: i.e. ***A community is a group of people living or working together in the same area. People in communities might go to the same schools, shop in the same stores and do the same things. They also help each other and solve problems together. ... Your neighborhood is a community. Your town or city is a community in your state. What is the name of our community?*** Pass out **11x17 sheets of paper,** and copies of the **COMMUNITY NEEDS** sheet. Ask students to make a **collage** of the important things in their community. Explain that they can use drawings or cut out pictures from magazines to complete their collage.

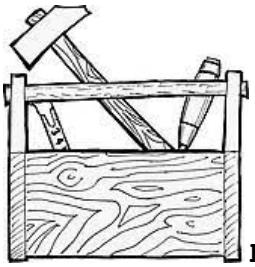
3. When the collages are completed, have volunteers describe what they included and why. On **MIMO,** use **SLIDE 1** (***What's in a Community***) and ask what they notice about the community they see on the screen.

4. Explain that everything in a community has a use. Have students identify one important thing shown in the **MIMIO** illustration. Ask: ***How do people use this important thing? How does it help people in the community? How many of you have included that item in his or her collage?*** Continue discussing

the items in both the illustration and the collages to explore why each item exists and how it helps a community.

5. **REFLECTION**: Distribute the ***Engineer's Notebooks*** and have students write their names on the cover. Have them open to the first page and to think about everything they discussed today. Explain that they will choose the two or three items they think are the most important to their community. Explain to the students that you will now be calling these items "**STRUCTURES**". Have them draw and possibly label these items. If time permits, have students share why they chose these structures. Ask: ***Why did you select these? What makes them important to your community? To your family?***

CHALLENGE 2 – WHO BUILT THAT?



Help students understand that engineers built the things in their community.

1. Distribute the ***Engineer's Notebooks***. Have students review the "**Important Structures in My Community**" page. Ask them what they remember about why the structures on the page are important to the community. Ask: ***How did the things in your community get there?"*** Discuss.

2. Explain that before a building is constructed, there is a very important person who must create a **BUILDING PLAN**. That person is called an **ARCHITECT**. On **MIMIO**, show **SLIDE 2** (***Who Builds a Community***). Tell them that this is a picture of an architect. An architects takes the idea for a community building and draws a plan of what it will look like and how it will work. Explain that architects are people who work very hard to be creative and "big thinkers". They go to special schools to learn how to use art, science, and math to make important drawings, called "plans", that will show builders how to build. The buildings architects draw must be safe and easy for people to use. Point out and discuss some of the tools shown in the **MIMIO** illustration.

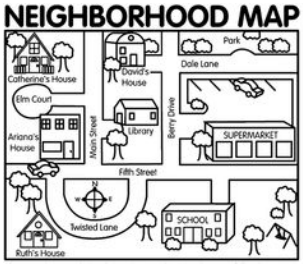
3. Ask: ***"After the architect has made the plans, what is the next step?"*** Students should say that the next step is to build. **CLICK** on **SLIDE 3** of **MIMIO** (***Who Builds a Community?).*** Tell them that after the building plan is done, the person who decides ***how*** to build is called an **ENGINEER.** Explain that engineers are builders and **PROBLEM-SOLVERS.** Some engineers build bridges, cars, airplanes and spaceships. Others work with computers, medicine, people, and the environment. Say: ***Look around you. Everything you see in this room, from the desks and chairs you're sitting on to the pencils and crayons you use, all involved an engineer at one time or another. In a community, engineers build the buildings – bridges, parks, and other things that we use.*** Point out and discuss some of the tools shown in the **MIMIO** illustration.

4. Tell the students that they will now team up to build something for their community using **LEGO** bricks. Separate students into groups of two. Explain that each of them has an important job to do. Together, they will decided if they will build a bridge or a building. Once they have decided what to build, they will work together as architectural teams and then engineering teams. Pass out **blank sheets of paper.** Explain that as architects, they will draw the bridge or building they want to build. Then, as engineers, they will use **LEGO** to make their builds. Encourage teams to discuss the best ways to build their designs before they get started. Remind teams to use their imaginations as they draw, but to make sure that it is possible to actually build their designs. Explain that if the plan needs to change as the engineers build, the architects should go back and change the drawing so that it matches.

5. **REFLECTION**

Pass out the ***Engineer's Notebooks.*** Have students open to page **2** "**We Build a Community**". Ask them to use page 2 to draw or write what an architect and an engineer do. Then, on page **3, "Our Building Project"**, have them copy the drawing their team created and then sketch what the final structure looked like.

CHALLENGE 3 – MAP IT!



Help students understand that there is an order to how communities are planned.

1. Use **MIMIO** to show **SLIDE 4** (***Maps! Maps! Maps!)*** and then **5** Ask students to identify what they see. They should answer that all the pictures are maps. Have a student explain what the different maps are for. Explain that maps show where things are placed. Tell students that there are all kinds of maps; there are maps of our world, there are maps of our country, there are maps of our states and cities, and maps of our communities. Explain that maps are very important to a community because they show what is there. People can use maps to find their way

around. People can also use maps to decide if a community has everything it needs.

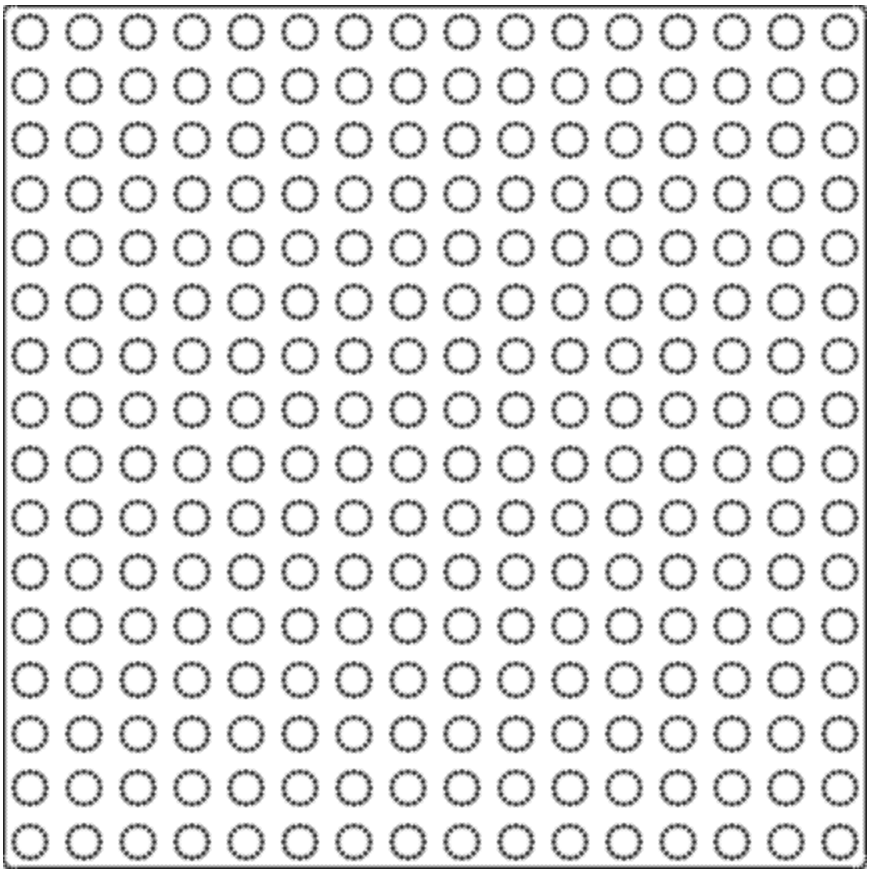
2. Discuss with students the things they say they could not live without and write these on a large sheet of paper (you'll be looking at this again later so don't toss it out). Hopefully they include things like food, water and shelter. When the list is complete, ask students where they go to get the things they need. As the answers come up – e.g. a grocery store – discuss where those things are located. Point out the all the things that people need are placed along streets and sidewalks so that people can reach them.

3. As water comes up, explain that water and other things that people need come into a community belowground. Show **MIMIO SLIDE 6** (**Things Above Things Below**). Show them the water pipes, electrical wires and gas lines show underground on the illustration. Explain that these important parts of the community are buried underneath the sidewalk, but they help keep your water clean, cook your food (gas), and help you see at night (electricity).

4. If no one has mentioned safety, explain that safety is something that is important to all communities. Ask: ***What are some of the things that make communities safe?*** Point out the traffic lights on the illustration. Tell students that architects and engineers have to think of all the things that are important to a community when they build.

5. Draw a simple map of your classroom on the board. Indicate desks, stations, doors, etc. Tell students that they will be using a large **LEGO** piece called a **BASE PLATE** to create a 3D map of your room, using **LEGO** bricks instead of furniture. First, create a KEY. Decide what color brick desks will be, stations, computers, etc. Draw these on a large index card. Also on the card draw a **COMPASS ROSE** that shows which direction your room faces. Next, have students work together to create your classroom map and display it along with KEY. Ask: ***What are the most important things to show on our map? What things can we leave out?***

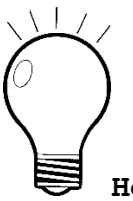
EXAMPLE:



6. **REFLECTION**

On page **4** of the ***Engineer's Notebook***, have students reflect on community needs. Allow students time to draw things or places that the community needs.

CHALLENGE 4 – WHAT IS INNOVATION?



Help students learn about new types of community designs.

1. Ask students: ***Can you ride a bike in the sky? Do schools float? Can you get water from a sign? Can a car drive itself? Why not? Do you think it is possible that those things could happen, someday?*** Explain that **ENGINEERS** have created new things for communities by using their imagination.

2. **CLICK** on **MIMIO SLIDE 7** (**Imagine That!**) Show them the billboard drawing. Explain that in a desert town in South America where there isn't a lot of water, there is a billboard that has a fan inside of it. The fan draws in the air, the air runs over very cold pipes, and water in the air drips out. The water runs down the pole of the sign and when people turn on the faucet, they get water!

3. Show the illustration of the Sky London bike lane. As for a volunteer to explain what they see. Ask someone else to explain why this bike lane would be in the sky. If they don't suggest it, guide students to think about the safety of the bikers, and how traffic would flow more quickly on both the bike lane and the streets if the cars and bikes were not traveling together. Explain that engineers are building this bike lane in London, England.

4. **CLICK** on **MIMIO 8.** Show them the floating school. Explain that in this particular African country, there is a community that lives on the water in houses built just above a lake. Because the water makes it difficult for children to travel to school and it is difficult to build large structures such as a school, an architect designed this floating school. Ask: ***Why would this be important?***

5. The final design shows a car that drives itself. Engineers in the United States are building cars that use computers to sense when it is near other objects and to navigate where to go.

6. Tell students that all the things that they have just seen are called **INNOVATIONS.** An innovation is something new that's never been created before. Explain that the most important innovations help communities to grow.

7. Using the list compiled in the previous lesson, ask students to recall the things that a community needs: food, water, things that help safety (such as traffic lights and stop signs), buildings for shelter and a play to play might all be examples. Ask: ***What would you like to have more of in your community? Do you need more safety in your community? Do you need more places***

to get food and water? Do you think everyone needs a place to play – even grown-ups? Have you ever seen a dog park? Ask: ***What are something interesting places or things you see in our community?***

8. Hand out ***Engineer's Notebooks*** and have students turn to page **5** ***What My Community Needs***. Ask them to write or draw a list of a community's needs in the top box. Next, ask "If you could choose one thing on your list to change, what would it be?" Have everyone choose one thing they want more of in their community and write it on the "**GOAL**" line in the bottom box, or draw a picture of it in the bottom box. Pass out some scrap paper. Say: ***You will now have to put on your thinking cap. Can you think of an innovation, or something new, that you could build to meet the goal you have written? Would it be some kind of machine? A building? Something that floats? Something that flies? Would it be big? Would it be small? What would it do?*** ? Ask as many questions as possible to inspire their imaginations. Once they have an idea, instruct students to draw this innovation on scrap paper. Circulate asking questions and giving advice. Once students are happy with their drawings, have them copy their sketches into their ***Engineer's Notebook*** on page **6** (***My Innovation: Sketch***) box (the first box, **not** the **REVISION** box. That comes later).

9. **REFLECTION** Lead students in a discussion to reflect on **CHALLENGE 4**. Ask: ***Was it easy to come up an idea? Was it hard or easy to draw that idea? What would you change about your drawing? Do you think engineers and architects spend a lot of time coming up with ideas? Why or why not?*** The goal of this discussion is to help students reflect on their process to better understand the role of engineers and others who help design things in their communities.

CHALLENGE 5 – WILL IT WORK?

Help students understand that engineers revise their designs to make them better before they build.

1. Have students share the **INNOVATION** pictures they drew in their ***Engineer's Notebook*** from **CHALLENGE 4.** Then explain that engineers don't build an innovation after just one drawing. Explain that there are a lot of steps that engineers go through before they build. That's how they decide if their innovation will work.

2. Distribute the ***Engineer's Notebooks*** and have students turn to page **6.** Tell them that there are steps they can follow to find out how they can make their innovations better. Read the **"STEPS TO MAKE INNOVATIONS BETTER"** out loud. Have students check off the steps they have completed.

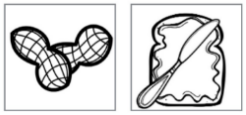
3. Explain how engineers use many types of drawings to show others what their idea is and how it will work. **CLICK on MIMIO SLIDE 8 (Ideas Start With Dreaming)** Have students look at these three examples of design: blueprints, diagrams and 3D drawings. Explain that drawings help an engineer demonstrate how his or her invention will work. These drawings also help everyone think about what problems may arise when it's built.

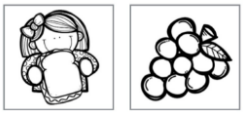
4. Divide students into groups of **3** or **4** and provide each with a set of **LEGO,** a set of **Challenge Cards** and a sand timer. Have students take turns drawing a card, setting the timer, and build following the directions on the card. When the sand runs out, students should discuss the following*:* ***What did the Builder like most about his build idea? What was confusing about their idea? What suggestions do the rest of the players have that***

would make the idea better? Remind students that they should be respectful of everyone's ideas, including their own.

5. **REFLECTION** After the **Challenge Game**, groups should come back together as a class. Ask: ***What did you learn? Did you or anyone else come up with an idea that made someone else's build better? When you give ideas to someone else, this is called FEEDBACK. Did you enjoy getting other people's feedback? Why or why not?*** Explain that engineers, architects and other builders revise, or change, their plans to make them better. For example, an architect would have to redesign a building plan to make sure that someone in a wheelchair has easy access to every room. They might have to make bigger doorways, elevators and ramps wherever there are stairs, etc. Explain that revising means fixing a few parts to make the whole better. Other people can often help us make a better plan! In the ***Engineer's Notebook***, have students turn to page **6** (**My Innovation** – first box labeled **SKETCH**) Allow them time to show this original design to a few classmates. After a brief discussion to get feedback from others, have students create a ***revised*** version of their first drawing (**My Innovation: Revision**). . They should change at least one thing to make their innovation even better. Older students can complete the bottom part "**What did I make better?**"

CHALLENGE 6 – HOW DOES IT WORK?





Help students practice sequential thinking and apply it to their own innovations.

1. Say "Now that you have revised, or changed, your innovations to make them better, it's time for you to explain how they work" **CLICK** on **MIMIO SLIDE 10** and then **11.** Walk them through the steps of operating an elevator: push the button; doors open; get in the elevator; push the button for your floor; doors close; elevator takes you to the floor; doors open; get out of elevator.

2. Explain that engineers don't only decide how the things they build will look, they also figure out how they will work. Distribute ***Engineer's Notebooks*** and have students turn to pages **7** and then **8 (This is How it Works).** Point out the blank spaces where they will draw or write the steps of how their innovations work.

3. Ask: ***What's the very first thing people will do when they use your innovation?*** Have younger students draw a picture of the first step using their innovation in the **STEP 1** box. Have older students write a description of the first step.

4. Continue to walk students through each step as needed. Ask: ***What is the next thing a person will do when they use your innovation?"*** Younger students should at least identify a beginning, middle and end. Provide frequent check-ins and consistent verbal cues to consider each step carefully.

5. **REFLECTION** After everyone has completed their steps, have a class discussion. Ask ***Do you think about your innovation differently now? Did you change your mind about how it works or how it might work? Is there anything you need to add to your drawing?***

CHALLENGE 7 – PRESENT YOUR IDEAS

Help students develop a presentation that shows their innovation.

1. Pass out the ***Engineer's Notebooks*** and copies of the **Innovation Template Sheet**. Explain that they are now ready to create final drawings to show others their innovations.

2. Tell students that they will draw their innovation as clearly and neatly as possible in the box on the **Innovation Template Sheet**. Instruct them to look at their revised drawings on page **6** and review their "***This is How it Works***" steps on pages **7** and **8** so that they can be sure they are including all their ideas in the final drawing. As students draw, walk around the room to check their progress.

3. Allow students time to color their innovation and decorate the sheet as they would like.

4. If students complete this stage before the end of the session, allow them to move on to **CHALLENGE 8,** drawing the steps of how their innovation works on the **Innovation Steps Template Sheet.**

5. **REFLECTION** Ask: **Was it challenging to redraw your innovation? Did you make any additional changes? How do you**

feel about your new innovation? If you were giving advice to others working on this same activity, what would you say?

CHALLENGE 8 – DEMONSTRATE HOW IT WORKS

Help students develop a presentation that shows the steps involved in using their innovation.

1. Pass out the ***Engineer's Notebooks*** and copies of the **Innovation Steps Template Sheet.** Students who have done a beginning, middle and end sequence should have three sheets. Students who have done the full six steps should have six sheets. Explain that they will include drawings of the steps for using their innovations in their presentations.

2. Ask students to look at their **"This is How it Works"** steps on pages **7** and **8** of their ***Engineer's Notebooks***. For the first step, they should write "1" on the blank line at the bottom of the **Innovation Steps Template Sheet.** They should then draw **Step 1** in the space on the template. Older students should write the sentence that explains **Step 1** of using their innovation on the Innovation **Steps Template Sheet.**

3. Have students follow this process to draw and describe three (beginning, middle and end) to six steps that show how to use their innovations. Once they have completed their drawings,

review them for clarity. After you have approved their drawings, allow students to color and decorate them.

4. When the Innovation drawing, as well as the **Innovation Steps** drawings are completed, pass out one **poster board** to each child.

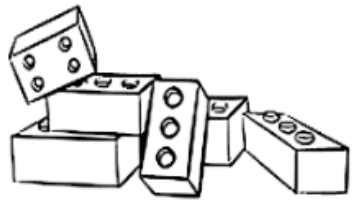
5. Allow students to name their Innovations and write the name of the innovation in bold letters across the top of the poster board. Then have them place their **Innovation Steps** drawings in numerical order across the bottom half of the poster.

6. Once everyone has organized their sheets on their poster board, pass out glue or tape so that they can attach the sheets. Make sure everyone puts their name on their poster board.

EXAMPLE:

7. **REFLECTION** Have students review their presentation posters. Ask: ***Did you think you could put together this idea when you started? Why or why not? What was challenging and how did you overcome that challenge? Does seeing your innovation come together get you excited about coming up with more ideas? Why or why not? How do you think an engineer or architect feels when they present an idea? Do you think it is easy or challenging for them to share their ideas? What might they do to be prepared to share their ideas?***

CHALLENGE – BUILD IT!



Help students create a 3D model of an innovation.

1. Congratulate your students! They have (hopefully) succeeded in going through the stages of creating an innovation! Students have used innovated thinking to create something new in response to a need in their community. Now it's time for them to build their innovation in 3D!

2. **CLICK** on **MIMIO SLIDE 12.** Discuss the images of engineering and design models shown on the screen. **CLICK** on **MIMIO SLIDE 13** to look at another image of a model.

3. Explain that they will now make a 3D model of their innovation using **LEGO.** Pass out containers of **LEGO** to build with. Follow this **link** to get some ideas of building techniques to share with your class: https://www.lego.com/en-us/family/make

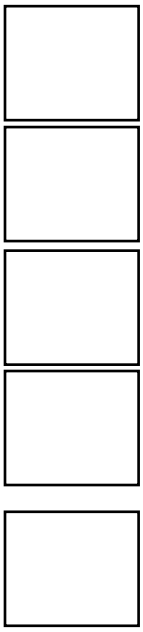
4. Pass out the ***Engineer's Notebook*** and have students study their drawings on page **3 "Our Building Project".** Have them observe what types of shapes they'll need to build to make a model of their innovation in 3D. Explain that it's important for them to be able to interpret the shape of their model, but the idea is to find a starting place to build.

5. Have a **Presentation Time**. Ask students to share their models with the rest of the class. Consider using the **Presentation Guide** to help students plan their presentations. After they have filled in all the blanks on their **Presentation Guide**, separate them into groups so they can practice making their presentations to small groups before they present to the entire group of students.

5. **REFLECTION** Thinking about the project as a whole, ask students to discuss the following questions as a group: ***What step did you like the most? Why? What step or steps were the most challenging? Why? What makes being an engineer or architect difficult?***

NORTH **SOUTH** **EAST** **WEST**

CLASSROOM KEY



Teacher Desk

Student Desk

Math Station

Reading Station

Computers