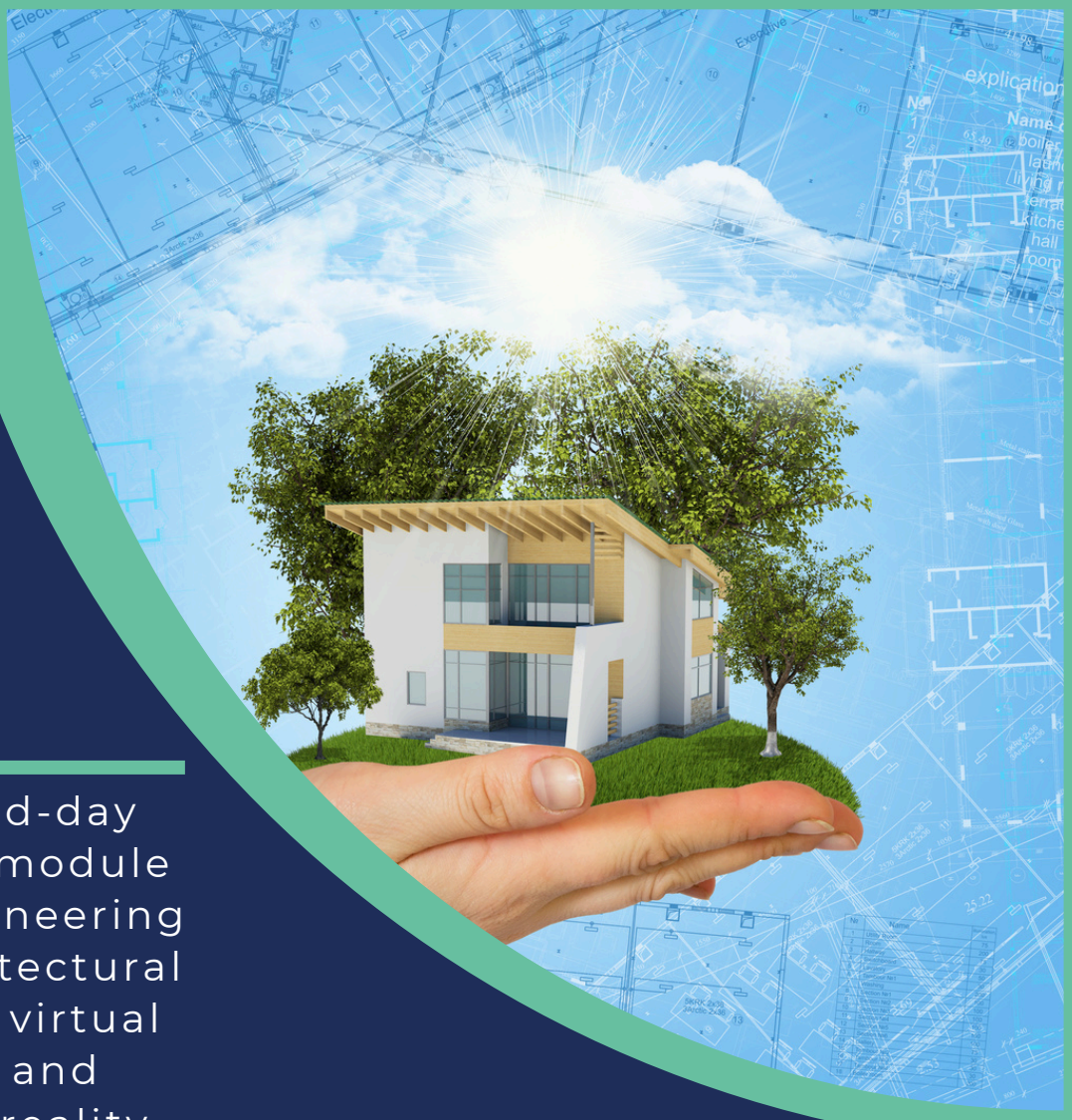
ARK-Educate

BUILDING THE FUTURE IN 3D

DESIGNING TINY HOMES FOR DISPLACED INDIVIDUALS



An extended-day enrichment module utilizing engineering design, architectural drafting, 3D virtual modeling, and augmented reality.

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THE ARK EDUCATION INITIATIVE DIFFERENCE

Igniting Tomorrow's Visionary Leaders

Founded in 2021 by Cathie Wood, the CEO of ARK Invest, the ARK Education Initiative is a nonprofit organization that works to improve education through technologically enabled **innovation**.

The ARK Education Initiative (ARK-Educate) difference begins with the belief that **innovation** solves real-world problems. Our programs make innovative thinking accessible to all students and educators, equipping them with the skills and mindset to manage profound technological change.

Our extended-day enrichment modules use research from ARK Invest analysts who acquire knowledge through exhaustive research and open, mutual sharing with other experts in various fields of **technology**. They provide insights into the opportunities and challenges driven by disruptive technological **innovation**.

Our modules go beyond STEM, teaching students how to synergize their science, **technology**, engineering, and mathematical skills along with their core content knowledge to solve real-world problems while using **engineering design processes** and **innovative technology**.

WHAT IS DISRUPTIVE INNOVATION?

Innovation goes beyond invention. Innovators are open to experimentation and exploration, resilient in the face of failure, capable of extracting lessons from temporary setbacks, and adept at thinking critically and with vision.

Disruptive Innovation refers to the introduction of a new product, service, or **technology** that significantly alters the existing market landscape. Over time, these **innovations** gain momentum, challenging and transforming industries by addressing unmet needs or creating new markets through a combination of technological advancement, affordability, and accessibility.

The Importance of Disruptive Innovation

Innovative education creates a template for life outside the classroom, developing a mindset of fearless inquiry and preparing students for future careers by helping students:

- Develop future-ready workforce skills needed for a rapidly evolving job market.
- Foster an entrepreneurial mindset by encouraging them to explore innovative solutions to new or existing problems.
- Understand how technological advancements **impact** society and global citizenship.

DISRUPTIVE BY DESIGN

Ark Educate offers transformative educational solutions that merge innovative technology, engineering design, career exploration, and a problem-first approach to learning.

Our programs are designed to revolutionize the educational landscape by equipping students with the skills, knowledge, and disruptive thinking needed to become tomorrow's visionary leaders.

MODULE OVERVIEW

Teams of students will utilize architectural drafting, **3D** virtual modeling, and **augmented reality** to **design** and construct a **model** of a tiny house intended for use as a temporary housing solution for homeless individuals.

Before teams **design** and build a tiny house, they will learn about various factors contributing to the need for temporary housing, such as unemployment, poverty, and housing affordability. Students will also learn about the United Nations' Sustainable Development Goals and how **innovation**, **technology**, and industry work together to solve global issues.

The Tiny House Design Challenge will require teams of students to **design** and build a **model** of a tiny dwelling that meets specific **design constraints**, including square footage **specifications** and the need for a bathroom, kitchen, sleeping area, living space, and storage. Students will learn about the principles and processes of the **engineering design process** and employ those steps during each phase of their build.

This module will take students through the following steps:

- Create an **architectural blueprint** for the layout of a tiny house using the design challenge **specifications**.
- Use their **architectural blueprint** to construct a **model** of the tiny house.
- Use the **engineering design process** to assess the feasibility of their **design** and modify their build as needed.
- Use the physical **model** to create a virtual interactive **3D model** of the tiny house using **augmented reality (AR)**. A virtual **model** of their **design** will help teams digitally analyze their **design** and determine if it solves the problem.
- Provide a presentation of their team's **design** solution using both physical and virtual models.

GETTING STARTED

- Module Lessons
- Module Key
- Scope and Sequence
- National Standards Alignment
- Engineering Design
- United Nation Global Goals for Sustainable Development
- Technology Specifications
- Module Materials
- Module Preparation

MODULE LESSONS

Lesson 1	The Endless Possibilities of Big Ideas	60 minutes
Lesson 2	Concrete Ideas: Building a Foundation for Impactful Solutions	60 minutes
Lessons 3-6	Thinking Big With Small Spaces: From 2D to 3D Models	240 minutes
Lessons 7-10	Architectural Innovations: Creating Modules Using Augmented Reality	240 minutes
Lessons 11-12	Career Connections & Entrepreneurial Experiences	120 minutes
Lesson 13	Shelter Innovators: Preparing to Present	60 minutes
Lessons 14-15	Shelter Innovators: Presenting Solutions for Displaced Individuals	120 minutes

Lesson Structure

- Overview
- Objectives
- Materials
- Lesson Preparation
- Informal Assessment Opportunities
- Lesson Activators (warm-up activities)
- Lesson
- Lesson Summarizers (wrap-up activities)
- Extension Activities

MODULE KEY

Vocabulary Terms

Vocabulary terms are highlighted in bold green text. You can find a list of vocabulary terms and their definitions in the Appendix at the end of this module and in the student notebook.

Facilitator Tips and Notes

Facilitator Notes include additional directions related to instructional strategies, content support, extension activities, safety considerations, and much more.

Facilitator Tips include information, advice, strategies, and suggestions designed to streamline the instructional **process** and effectively deliver the content to support student engagement.

Student Handouts and Facilitator Reference Documents

Student pages, facilitator reference documents, and backline masters are provided at the end of each lesson. Student pages can also be found in the "*Setting the Stage for Innovation*" student notebook.

SCOPE AND SEQUENCE

Module Objectives

After this module, students will be able to:

- Apply the concept of needs versus wants to the components of a home by distinguishing between necessary features (needs) and optional enhancements (wants).
- Identify why idea generation and solution-seeking are essential skills to have as future **innovative** leaders.
- Identify and explain the steps of the **engineering design process**.
- Explain how building physical and **augmented reality models** helps assess if a **design** solution solves the real-world challenge.
- Demonstrate understanding of the **engineering design process** by creating and evaluating **2D** models, **3D** models, and **augmented reality** representations.
- Explain the importance of **criteria** and **constraints** in a design challenge.
- Analyze another team's tiny designs, providing constructive feedback.

Module Duration

- 15 lessons
- 1 lesson = approximately 60 minutes of instructional time.

NATIONAL STANDARDS ALIGNMENT

Next Generation Science Standards*

Engineering Design

- 3-5-ETS1-1
- 3-5-ETS1-2
- 3-5-ETS1-3

**Next Generation Science Standards* and NGSS is a registered trademark of WestEd. Neither WestEd nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and do not endorse it.*

Common Core State Standards*

Common Core State Standards for Mathematics

- CCSS.MATH.CONTENT.5.G.B.3
- CCSS.MATH.PRACTICE.MP1
- CCSS.MATH.PRACTICE.MP3
- CCSS.MATH.PRACTICE.MP5

College and Career Readiness Anchor Standards for Reading

- CCSS.ELA-LITERACY.CCRA.R.7
- CCSS.ELA-LITERACY.CCRA.R.8
- CCSS.ELA-LITERACY.CCRA.R.9

College and Career Readiness Anchor Standards for Speaking and Listening

- CCSS.ELA-LITERACY.CCRA.SL.1
- CCSS.ELA-LITERACY.CCRA.SL.2
- CCSS.ELA-LITERACY.CCRA.SL.3
- CCSS.ELA-LITERACY.CCRA.SL.4
- CCSS.ELA-LITERACY.CCRA.SL.5
- CCSS.ELA-LITERACY.CCRA.SL.6

College and Career Readiness Anchor Standards for Language

- CCSS.ELA-LITERACY.CCRA.L.1
- CCSS.ELA-LITERACY.CCRA.L.6

International Society For Technology In Education*

- ISTE 1.1 d Technology Operations
- ISTE 1.3.d Explore Real-World Issues
- ISTE 1.4.a Design Process
- ISTE 1.4.b Design Constraints
- ISTE 1.4.c Prototypes
- ISTE 1.4.d Open-Ended Problems
- ISTE 1.6.a Choose Platforms or Tools
- ISTE 1.6.c Models and Visualizations
- ISTE 1.6.d Customize the Message
- ISTE 1.7.c Project Teams
- ISTE .7.d Local and Global Issues

ENGINEERING DESIGN

Understanding the Engineering Design Process

The **engineering design process** is a systematic approach individuals (**engineers**, developers, scientists, inventors, etc.) use to solve problems and develop new products. It typically involves a series of steps that guide the creation, **testing**, and **refinement** of a product, system, or **process**.

This **process** differs from the scientific method since it involves designing, building, and **testing** a solution for a specific problem rather than conducting experiments and making observations. Although the **engineering design process** places more emphasis on inquiry, students should still be encouraged to act as scientists and researchers while they create diagrams, build **models**, use **technology**, apply mathematical principles, and employ technical literacy practices.

There is no single **engineering design process** that is universally accepted; however, the most common characteristic of such a

process is that it is iterative, which means that the steps can be repeated multiple times to allow for improvements after each **test**.

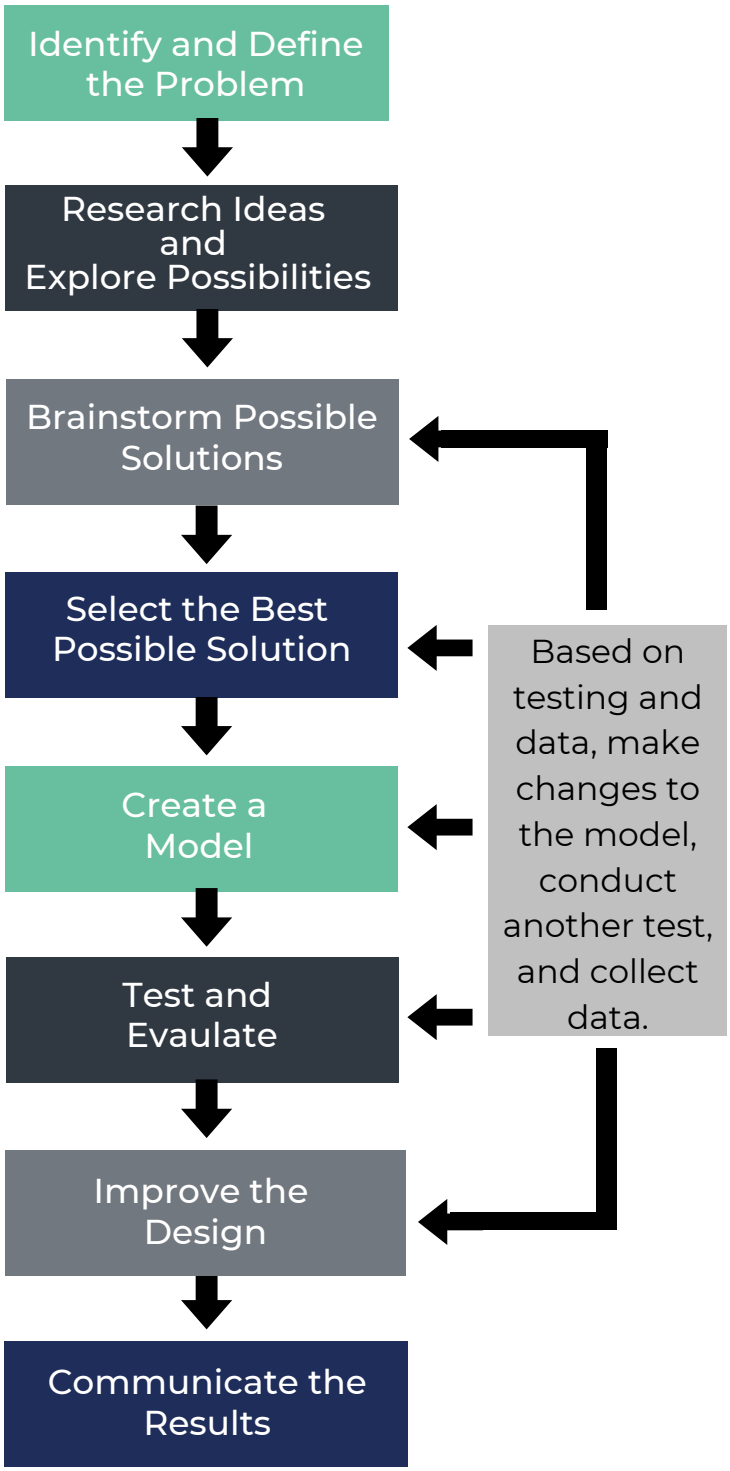
The following pages outline the **engineering design process** and associated descriptors used by ARK-Educate.

Facilitators of Inquiry

This module utilizes the **engineering design process**, thus transforming the role from a traditional instructional leader to an inquiry facilitator. When the facilitator asks probing questions and encourages teams to analyze their **designs** and data, students take ownership of their learning and learn how to navigate complex problems and uncertainty in a safe learning space.

Engineering Design Process

ARK-Educate



Engineering Design Process

ARK-Educate

Identify and Define the Problem	• What is the problem that needs to be solved? • Who or what population is the design product or solution for? • Why is it important to solve this problem? • What are the design criteria and constraints?
Research Ideas and Explore Possibilities	• Conduct research to identify if existing products or solutions already exist. • Explore who the users or customers were of each product or solution and its strengths and weaknesses.
Brainstorm Solutions	• Generate a list of design solutions and technology that could be used to solve the problem. • Withhold judgment to increase the number of potential solutions.
Select the Best Possible Solution	• Examine and analyze all brainstormed solutions to identify their strengths, weaknesses, and their ability to solve the design challenge. • Select one solution, draw an annotated diagram, and create a materials list.
Create a Model	• Build the model (design product) using the diagram and materials list. • If revisions are made to the model during construction, document these changes on the existing diagram and materials list.
Test and Evaluate	• Test the design product. • Record observations, measurements, and data taken during the test. • Evaluate how well the model solves the problem and meets the design criteria. • What improvements should be made to improve the design.
Improve the Design	• Modify the model using the notes, data, and observations collected from the test phase. • If revisions are made, document the changes on the diagram and materials list.
Communicate the Results	• Collaborate with team members to determine the best way to communicate the teams' design solution, how it should be displayed during the presentation, and how the results will be shared.

Student Collaboration

During this 10-week module, students will work in teams. When faced with challenges or obstacles during the **design process**, working together enables students to **brainstorm** ideas, share insights, and develop creative solutions as a team. This type of collaboration fosters the development of **communication**, active listening, idea generation, giving and receiving feedback, and conflict resolution skills, building their interpersonal relationship and project development skills, giving them the soft skills employers value in today's competitive job market.

Failure

Failure is essential to **engineering design** because it provides valuable learning opportunities. Analyzing what went wrong can deepen a team's understanding and reveal insights that lead to improvements in future iterations. Overcoming failure as a team builds resilience and perseverance. Failure in a **design** can be used as a teaching **tool**, allowing students to learn how to bounce back from setbacks and adapt to challenges as individuals and as a collective team.

UNITED NATIONS GLOBAL GOALS FOR SUSTAINABLE DEVELOPMENT

The *United Nations Sustainable Development Goals* (SDGs) provide a shared **blueprint** for peace, prosperity, and a more sustainable future. By integrating the SDGs into *ARK-Educate's Building the Future in **3D*** module, students can learn about the interconnectedness of issues such as basic needs, **innovation**, empathy, collaboration, and sustainable development for a more equitable world.

United Nations. (n.d.). Sustainable Development Goals. Retrieved from https://sdgs.un.org/goals

This module combines disruptive **innovation** and the SDGs with a specific focus on Goals 1, 9, and 11.

Each 15-week ARK-Educate module will focus on specific Global Goals, directly linking them to the real-world design challenge presented in each module. This approach ensures that students understand these goals and apply them in practical and meaningful ways, fostering innovative solutions to local and global issues.

TECHNOLOGY SPECIFICATIONS

Augmented Reality

A virtual tiny house can be created using CoSpaces Edu's web version or the CoSpaces Edu app downloaded onto a mobile device or tablet.

To transform a physical build into an **augmented reality** experience, students will need access to a mobile device or tablet that includes the CoSpaces Edu app and the Merge Cube.

CoSpaces Edu in the Browser

To use CoSpaces Edu on the web, you will need an up-to-date browser that supports WebGL. Most modern browsers have WebGL support.

- The latest version of Google Chrome, Firefox, Edge, or Safari should be used.
- Check that your browser supports WebGL with the compatibility table at https://caniuse.com/webgl.

CoSpaces Edu Mobile and Tablet App

The CoSpaces Edu mobile app. can be downloaded onto any mobile device or tablet.

- Tablets and mobile devices must have a built-in gyroscope sensor.
- The better your tablet or mobile device's GPU (Graphics Processing Units), the better the performance of any real-time **3D** graphics application and, therefore, the better the performance of CoSpaces Edu.

Android Devices

- CoSpaces Edu Android app runs on Android 4.4 and higher
- Android 8 OS and newer
- Minimum 2GB of RAM
- To experience CoSpaces in AR, the Android device must have a built-in gyroscope sensor
- For a list of AR-compatible Android devices: https://developers.google.com/ar/devices
- Download the CoSpaces Edu Android app from the Google Play Store

Apple Devices

- Apple Devices: iOS 14 and newer
- The CoSpaces Edu iOS app runs on iOS 8 and higher
- Minimum 2GB of RAM
- To experience CoSpaces in AR, the Apple device must have a built-in gyroscope sensor
- For a list of AR-compatible Apple devices: https://www.cospaces.io/tech-check-ar-with-tablets
- Download the CoSpaces Edu iOS app on the Apple Store

Troubleshooting

Firewall

If you are unable to access CoSpaces Edu on a school-issued device, it may be that your district has a firewall that blocks certain domains and might prevent you from accessing CoSpaces Edu.

To resolve this, it will be necessary to allow all of the domains needed to access CoSpaces Edu's online platform and apps. Please contact your IT department and ask them to whitelist the following domains and ports: cospaces.io, edu.cospaces.io,

cdn.edu.cospaces.io, cdn.edu.cospaces.io, r1.edu.cospaces.io, r2.edu.cospaces.io, r3.edu.cospaces.io, cdn.r1.edu.cospaces.io, cdn.r2.edu.cospaces.io, cdn.r3.edu.cospaces.io, and cdn.delightex.com.

GPU

If WebGL is disabled, you may need to enable it manually using the instructions at https://www.cospaces.io/tech-check-browser. In order to provide the best user experience, some browsers may selectively enable or disable support for WebGL for certain graphics even when you have the latest version of your operating system and browser installed.

You can use https://get.webgl.org/ to check whether the browser you're currently using supports and has WebGL enabled.

If additional technical support is needed:

- You can access the School IT Troubleshooting Guide: https://www.cospaces.io/tech-check.
- Contact the CoSpaces team for direct support: https://www.cospaces.io/contact-us.

MODULE MATERIALS

Facilitator Use

- 1 laptop or desktop and associated charging cord (provided by the school district)
- projector or SmartBoard (provided by the school district)
- 1 tablet or mobile device and associated charging cord (provided by the school district)
- 1 *Building the Future in 3D* facilitator guide
- 1 Building *the Future in 3D* slide deck
- 1 *What Do You Do with an Idea?* book by Kobi Yamada
- 1 cardboard box net
- 1 set of lightbulb stickers
- 6 sheets of 8.5" x 10" white copy paper (facilitator provided)

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 pen (blue or black)
- 1 cardboard box net
- 20 blank *Big Ideas Cards*
- 1 pair of scissors
- 1 set of light bulb stickers (the facilitator will determine how many per students)
- 1 glue stick
- 1 clear ruler
- 1 *Building the Future in 3D* student notebook

Per Team

Materials are provided for five teams, each with four students.

- 1 mobile device or tablet and associated charging cord (Provided by the school district)
- 1 package of thin colored markers
- 1 package of crayons
- 1 *Big Ideas Box Assembly and Card Content Directions* packet
- 1 *Tiny House Living Newsletter*
- 1 *Designing and Building a Tiny Home Blueprint Templates* packet
- 1 "A Global Changemaker" article
- 1 *Transforming a Physical Build to Augmented Reality* packet

Class Use

Craft materials to decorate the boxes (optional). See Lesson 1 for additional details.

- stickers
- colored paper
- Legos

MODULE PREPARATION

Before the lesson:

- Identify a location where materials and equipment can be stored securely between class sessions.

- Ensure that all **technology** (e.g., tablets, computer) are fully charged, can connect to WiFi, and have the necessary apps installed.

- During Lessons 3-5, each team will be assigned a **technology** device (e.g., tablet, computer). It is suggested teams receive the same device each week. Use the “Team and Technology Assignments” document in the Appendix to document which device is assigned to each team.

- It is important to be sensitive to students' feelings during this module, as you may have students who are or have been homeless, students who are living in poverty, or students who are in the foster care system.

- When facilitating this curriculum, please note that although the term "module" refers to a set of lessons, the term "unit" can be used interchangeably when speaking with students, as this is a term they are more familiar with.

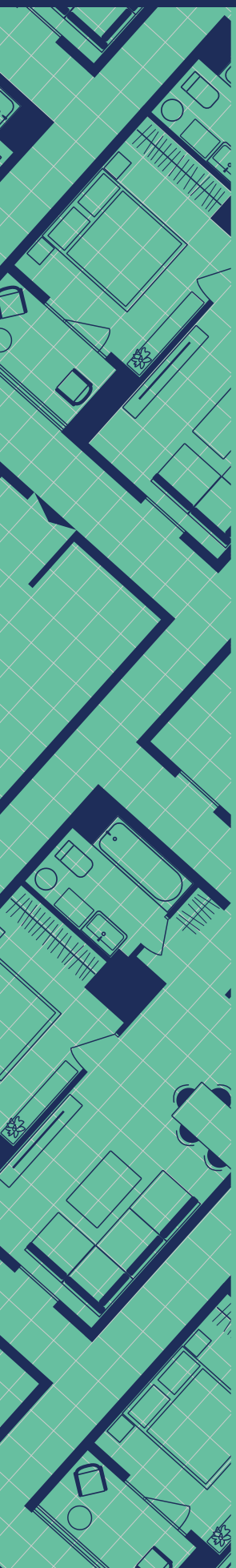
- Be aware that Habitat for Humanity* and other organizations prefer the following distinct definitions for each:
  - Shelter: The concept that humans need a place to live.
  - Home: The concept of family and social organizations that can be fostered by adequate housing.
  - Housing: The term that encompasses the physical structure to satisfy the need of shelter (e.g., a house or an apartment).

- Grouping Students for Teamwork: Students need to be arranged into teams before the start of this lesson. Teams will work together for the remainder of the module. When grouping students, it is important to consider a variety of factors to ensure a positive and productive learning experience for all. Below are guidelines to consider when grouping students.

- Class and Team Size: Students must be placed into teams before they are introduced to the real-world design challenge. If there are 20 students in the class, five teams should be created, each with four students. However, if the class size is more or less than 20 students, the team size and the number of teams must be adjusted accordingly.
- Mixed Ability Levels: Consider grouping students with a range of abilities to encourage collaboration and peer learning. This allows students to support and learn from one another.
- Interests and Strengths: Take into account students' interests and strengths when forming teams. Common interests and strengths can foster engagement and motivation as students work on tasks aligned with their passions and skills
- Diversity: Aim for diversity within teams, including gender, cultural background, and learning styles. This promotes the development of social skills and empathy among students.

- Once teams have been established, name tags should be created and used to place students next to their assigned team members prior to the start of class.

- **Facilitator Note**: The Appendix includes a “Team and Technology Assignments” document that can be used to record each team, the students in each team, and the team name members selected for themselves.



LESSON 1

THE ENDLESS POSSIBILITIES OF BIG IDEAS

OVERVIEW

This module aims to inspire a lifelong appreciation for ideas and the exciting possibility of turning them into reality.

Lesson Activators

- Background Building: What do you do with a problem?
- Activity: Big Ideas

Design Challenge

- Background Building: Design Challenge Scenario
- Activity: A Letter from the Mayor

The steps of the Engineering Design Process Addressed in This Lesson:

- Identify and Define the Problem

Lesson Summarizers

- Lesson Summary: discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: Encourage students to ask questions about the day's lesson.
- Lesson Preview: an overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Identify why idea generation and solution-seeking are essential skills to have as future innovative leaders.
- Provide reasons why it is important to document during each step of the **engineering design process**.
- Explain the purpose, **criteria**, and **constraints** identified in the real-world design challenge.
- Identify why some individuals require temporary housing assistance.

VOCABULARY

3D (three dimensional)

augmented reality

blueprint

brainstorm

communicate

constraint

criteria

design

diagram

engineer

engineering design process

innovation

innovative technology

model

technology

MATERIALS

Facilitator Use

- laptop or desktop
- projector or SmartBoard
- *Building the Future in 3D* slide deck
- "Team and Technology Assignments" document (located in the Appendix)

Per Student

Materials are provided for a class of 20 students.

- 1 pen (blue or black)
- 1 pencil
- 1 cardboard box net
- 20 blank *Big Ideas Cards*
- 1 pair of scissors
- 1 *Building the Future in 3D* student notebook

- 1 set of light bulb stickers (quantity determined by the facilitator)

Per Team

Materials are provided for five teams, each with four students.

- 1 package of thin colored markers
- 1 *Big Ideas Box Assembly and Card Content Directions* packet

Class Use

- craft materials (optional for students to decorate their *Big Ideas* boxes) facilitator provided

PREPARATION

Before the lesson:

- Ensure the projector, SmartBoard, and laptop/desktop are connected and working correctly.
- Open the *Building the Future in 3D* slide deck and display the slide "*The Endless Possibilities Of Big Ideas*" (Slide 1).
- Grouping Students for Teamwork: Students need to be arranged into teams prior to the start of this lesson. and will work together for the remainder of the module. When grouping students, it is important to consider a variety of factors to ensure a positive and productive learning experience for all. Below are guidelines to consider when grouping students.
    - Class and Team Size: Students must be placed into teams before they are introduced to the real-world design challenge. If there are 20 students in the class, five teams should be created, each with four students. However, if the class size is more or less than 20 students, the team size and the number of teams must be adjusted accordingly.

- Mixed Ability Levels: Consider grouping students with a range of abilities to encourage collaboration and peer learning. This allows students to support and learn from one another.
- Interests and Strengths: Take into account students' interests and strengths when forming teams. Common interests and strengths can foster engagement and motivation as students work on tasks aligned with their passions and skills.
- Diversity: Aim for diversity within teams, including gender, cultural background, and learning styles. This promotes the development of social skills and empathy among students.

- **Facilitator Note:** The Appendix includes a *Team and Technology Assignments* document to record the students in each team, and the name of the team members selected for themselves.

ASSESSMENTS

- Observations: As students complete various activities, note their individual levels of engagement, their ability to think critically, and their ability to **communicate** effectively. Use their responses and observed peer interactions to informally assess their critical thinking abilities and **communication** skills.

- Questioning: Ask probing questions about the design challenge, **criteria**, and **constraints** to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Written Responses: Facilitators should collect and review students' written answers at the end of each lesson. Analyzing written responses can yield valuable insights into students' level of conceptual understanding. This also allows the facilitator to tailor future instruction accordingly to support students' individual learning needs.

LESSON ACTIVATORS

Background Building: What Do You Do With an Idea?

1. Welcome students into the class.

2. Purpose: Share the following statement with the class:

   You are about to embark on an exciting experience where you will become solution-seekers, innovators, leaders, and problem-solvers.

   In today's lesson, you will learn about a real-world problem that you will be challenged to solve. Before you jump into finding a solution, we need to build your background knowledge about ***ideas***, ***solution-seeking***, *and the* ***importance of limitless possibilities***.

   Exploring these topics will help you approach the challenge with curiosity, determination, and the belief that ***YOU*** *have the power to make a positive* ***impact*** *on other people's lives.*

3. Display the slide “What Do You Do with an Idea?” (Slide 2).

   Tell students to find a partner and discuss what they think the book is about.

4. Read aloud the book *What Do You Do with an Idea?* by Kobi Yamada. While reading, emphasize the importance of ideas, determination, and students' limitless potential.

5. Hold a brief class discussion using the following questions:
   - What was the main idea or message of the book?
   - Give examples of how the idea grew and changed throughout the story.
   - Have you ever had an idea you were initially unsure about? If so, what did you do with it?

Activity: Big Ideas Box Building

1. Display the slide “Big Ideas Box” (Slide 3). Inform the class that today, they are going to build a *Big Ideas Box*. Share the following with the class:

   “The purpose of building a Big Ideas Box is so that they have a place to store all their ideas. Keeping all of your ideas and solutions in one place is a great way to see how your ideas, creative thinking, and solution-seeking change and grow over time.”

2. Inform the class that these photographs are only being shown to give them ideas how they will be able to personalize their *Big Ideas Box*.

3. Tell the class that you are going to place students into the teams they will work with for the remainder of the module.

4. Give teams a few minutes to create a team name.

- **Facilitator Tip:** The names of each team should be written on the "Team and Technology Assignments" document.

5. Next, display the slide "Big Ideas Box Materials List" *(Slide 4)*. Ask teams to identify one person in their team who will serve as the Materials Manager. This person will be responsible for gathering the materials listed on the slide.

6. Once each team has its materials, they should begin to read through the *Big Ideas Box Assembly and Card Content Directions* packet.

7. After students finish building their boxes and writing on their cards, tell the class that each week, they will be given time to add new ideas and revise existing ones to their *Big Ideas Box*.

8. Summarize the importance of ideas and the limitless potential each student holds within them to make positive changes in their community and beyond.

DESIGN CHALLENGE

Background Building: Design Challenge Scenario

1. Tell the class that they are about to be presented with a real-world challenge which they will be tasked with solving. Display the slide "*Real-World Design Challenge*" (Slide 5) and read the content aloud to the class.

   Over the next ten weeks, you will embark on an exciting journey of creativity, problem-solving, ***innovative technology****, and hands-on learning.*

2. Next, display the slide "*Real-World Design Challenge Continued*" (Slide 6) and ask students to read the content independently.

   Get ready to dive into a real-world challenge that will ask you to ***design*** *and build a solution for a specific need within your community. To do this, you will get to unleash your imagination, work collaboratively, and use* ***innovative technology*** *to bring your ideas to life!*

3. Display the slide "Are You Ready to Learn About Your Real-World Design Challenge?" (Slide 7). Before displaying the next slide, tell the class that you are going to share a story:

   Your school district owns a large piece of land that is no longer used. Rather than selling it, the district has decided to donate it to the city. However, the donation comes with a condition- the land must only be used to support the local community.

   The city's mayor was so impressed by the school district's decision that they decided the students should have a large part in ***designing*** *and developing the land for the community.*

   To express their appreciation, the mayor sent a letter to YOU, the city's students!

   - **Facilitator Tip:** When reading the situational prompt, emphasize the word "YOU" when reading to reinforce the idea that the students should now see themselves as the students the mayor is speaking to.

4. Ask students to sit with their team.

   Tell teams to identify one Materials Manager who will be responsible for getting one *Building the Future in 3D* student notebook and one pen for each team member.

5. Ask students to complete the information on the front of the notebook with their pen.

   Give teams a few minutes to look through their notebooks and discuss its contents.

6. Tell the class that although they will work with their team to find a solution to the real-world challenge, it is important they record their own information in their notebook. At the end of this module, each student will have a notebook to take home with them filled with ideas, **designs**, and thoughts they can expand upon.

   - **Facilitator Note:** Depending on the class and the school's community, you may need to provide a disclaimer that the mayor referenced in the story is not the actual Mayor of their city; however, the design challenge is a real-world problem that cities nationwide have to examine and solve.

7. Ask students to open their notebooks to the Mayor's letter. Emphasize that the city's Mayor wrote this letter to **THEM**. Team members should read through both pages together.

8. Display the slide "*Building the Future in 3D: Design Challenge*" (Slide 8). After teams have read both pages, hold a class discussion, to help students clarify what they are challenged to solve, and the population their solution would help.

9. Display the slide "*Building the Future in 3D: Design Challenge Continued*" (Slide 9). Discuss the concepts of **criteria** and **constraints** and have teams identify what they are in this challenge.

10. Wrap up this part of the lesson by asking students to turn to another student and complete the following statement, "One thing I am excited related to this real-world problem is……"

LESSON SUMMARIZERS

1. Summarize: Ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections.

2. Student Questions: Encourage students to ask any final questions about the day's lesson.

3. Lesson Preview: To build excitement, provide examples of the content and activities students will interact with during the next lesson. Inform the class that the following week, they will view the **innovative technology tool** that will make their physical build come to life using **augmented reality**.

EXTENSION ACTIVITIES

For students who finish early or need an extension learning experience:

- Create a Digital Story: Have students create a digital story or video highlighting the importance of understanding big ideas and **brainstorming** solutions to real-world challenges. This digital story could be shared with another fifth-grade class who is not completing this module.

- School Problem Scavenger Hunt: Students could conduct a scavenger hunt around the school to identify potential issues such as waste management, safety concerns, or accessibility. They could then **brainstorm** solutions and create a presentation to share with the school's administrators.

- Student-Led Surveys: Students could create and distribute surveys to their peers and staff to gather feedback on areas of improvement within the school. Then, they would analyze the survey results to identify common problems that can be addressed. Students would put together an infographic to display and share their findings.

THE ENDLESS POSSIBILITIES OF BIG IDEAS

BUILD GUIDE

MATERIALS

Per Student

- 1 cardboard box net
- 20 Big Ideas Cards
- 1 set of lightbulb stickers

Per Team

- 1 package of thin markers
- craft supplies (optional)

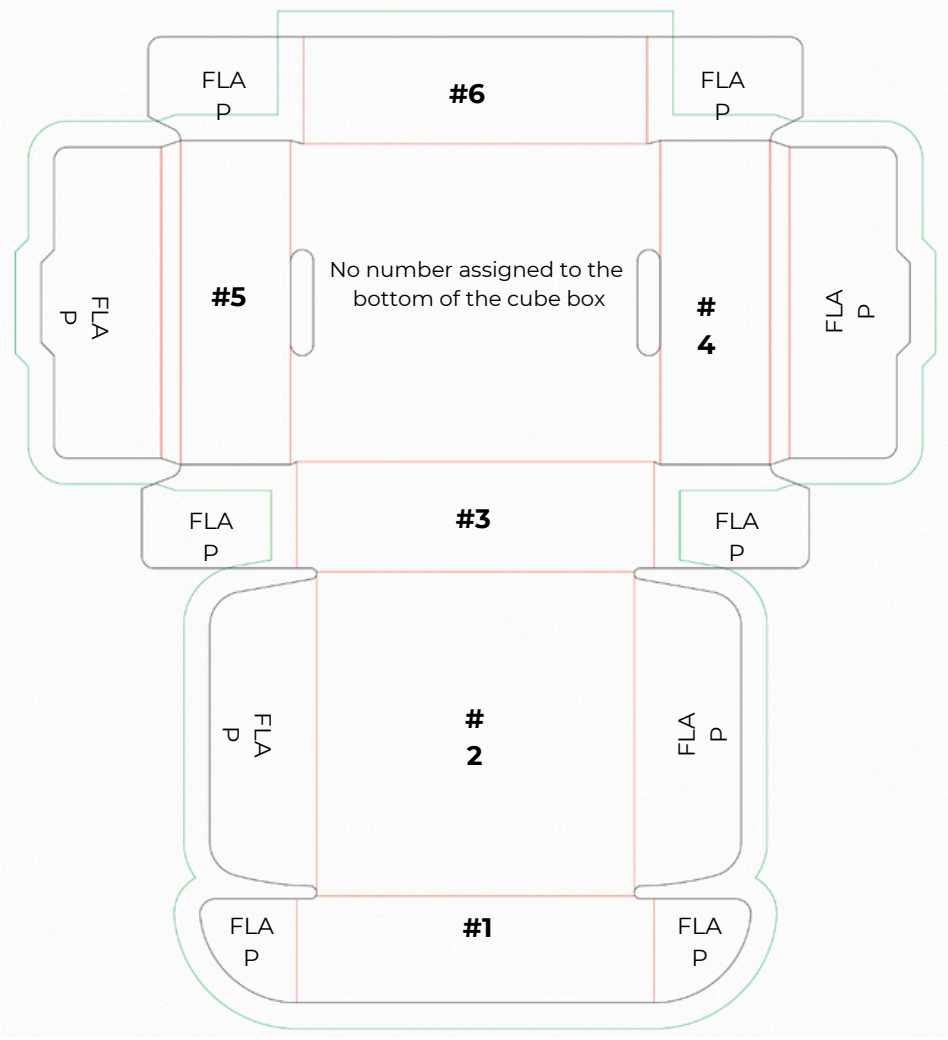
Use the directions on the following pages to build your own

Big Ideas Box!

BIG IDEAS BOX

STEP 1: WHITE SIDE OF BOX NET

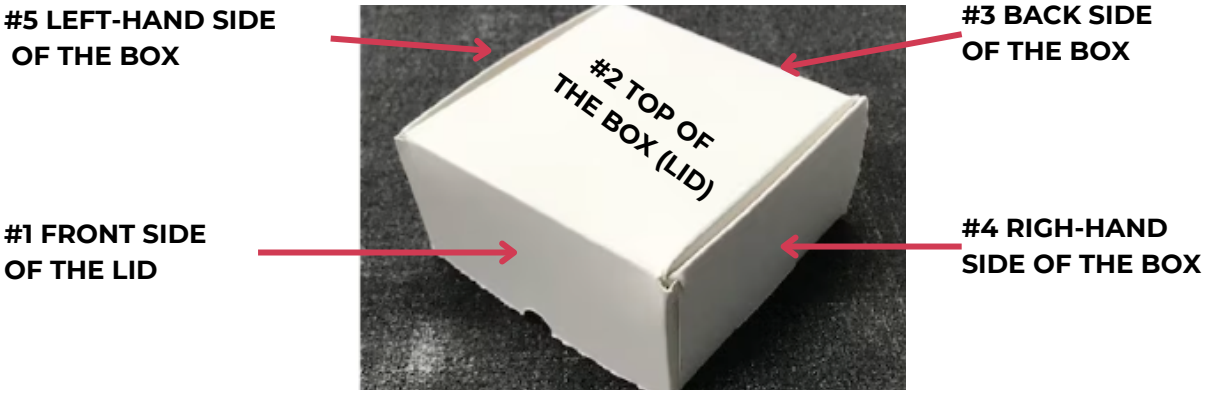
Place the box net on the desk with the white side facing up. It should be in the same position as the diagram below.

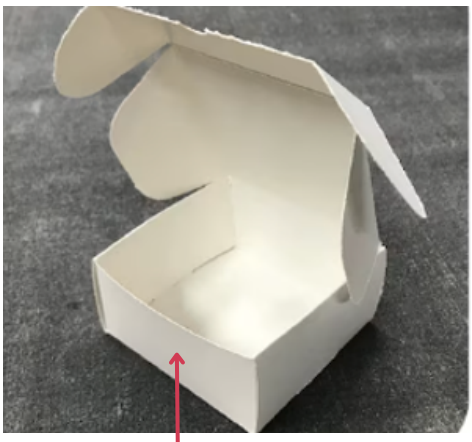


STEP 2: BOX CONTENT SECTIONS 1-6

Using a set of thin colored markers and the directions below, add the following content to each section.

- **Section 1:** Add your first and last name.
- **Section 2:** Add the title, Big Ideas and Endless Possibilities.
- **Section 3:** List one or two fun facts about yourself, such as places you have visited, unique talents, and favorite food.
- **Section 4:** Add two of your favorite interests or hobbies.
- **Section 5:** List two to three jobs you find interesting.
- **Section 6:** Add a personal accomplishment you are proud of or would like to accomplish one day.

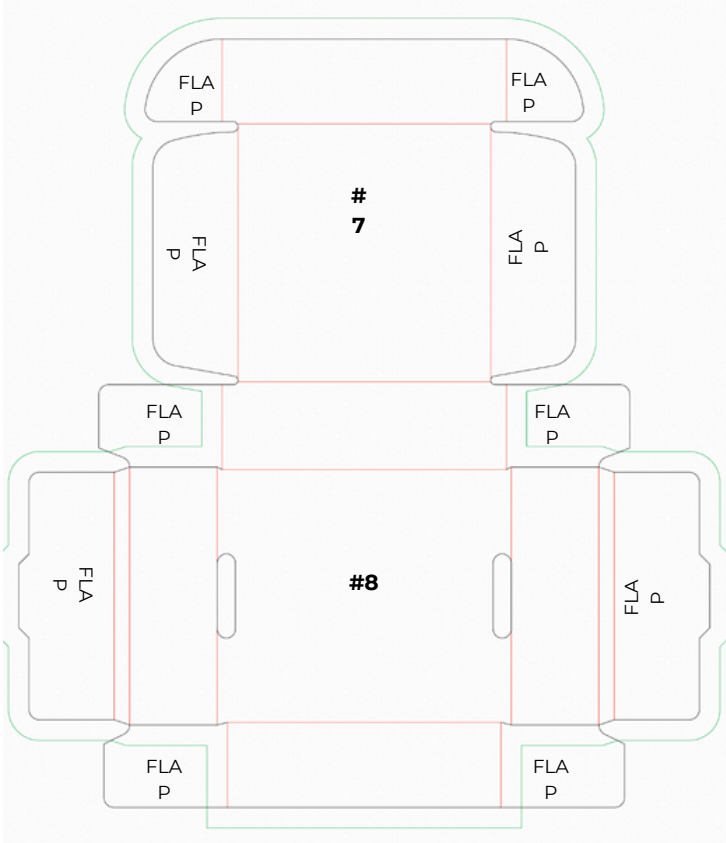




#6 INTERIOR FRONT SIDE OF THE BOX

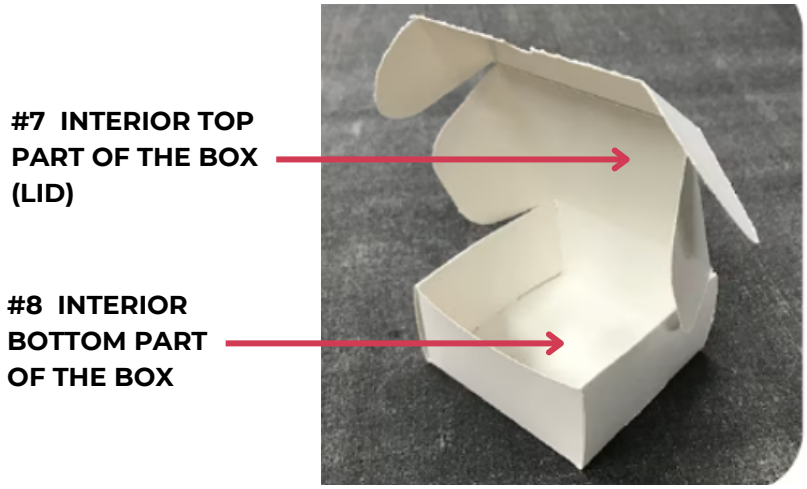
STEP 3: BROWN SIDE OF BOX NET

Turn over the box net to display its brown side, positioning the box net exactly as shown in the diagram below.



STEP 4: BOX CONTENT SECTIONS 7-8

- **Section 7:** Add words you would use to describe yourself. You will determine the number of words you would like to write.
- **Section 8:** Free Choice - You can decide what to write or draw in this section. Examples: inspirational words, an illustration of yourself, and illustrations of your favorite subject.

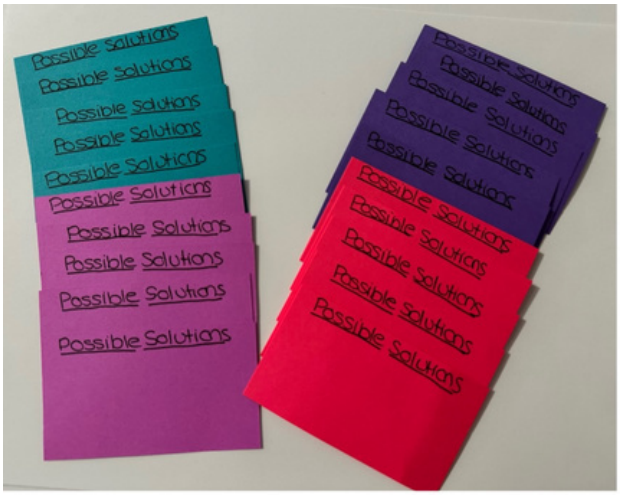


BIG IDEAS CARDS

STEP 5: BIG IDEAS CARDS

1. Count your cards to ensure you received 20 of them.
2. On the one side of each card, at the top, write the title “Idea.”

3. On the back side of each card, at the top, write the title “Possible Solutions.”



STEP 6: BIG IDEAS CARD CONTENT

1. Select one card in any color.
2. On the side of the card with the word “Ideas,” record one idea (one problem) you would like to solve.
   - Problems can be an issue you have encountered, an issue a friend or family member has experienced, or a problem you would like to fix or improve at your school, home, or community.
3. On the side of the card with the words “Possible Solution,” record one way you might be able to solve this problem.
4. Place the completed card in your Big Ideas Box.
5. If additional time permits, select a second card and complete the same **process**.
6. At the end of this activity, place your completed and blank cards inside your Big Ideas Box.

You will be given time each week to complete 1- 2 Big Idea Cards. The number of cards you complete is up to you, with the expectation that you complete at least one card per week. At the end of this module, you will have a BOX FULL OF “BIG IDEAS“ to take home with you!

Dear Students,

As your Mayor, I am reaching out to you with an important opportunity and challenge for our community.

Our city is facing a critical issue that requires innovative solutions. The increasing cost of living, including rent prices, home values, insurance costs, and other factors, has led to a rise in homelessness among our fellow community members.

In response to this pressing need, I am calling upon you—the city's bright minds and future leaders—to take an active role in addressing this challenge by designing and developing small, temporary housing solutions for our homeless population.

Your creativity, ingenuity, and compassion are the cornerstones of our community's strength. By working together, we can create spaces that provide temporary shelter and support for those in need. These solutions can make a meaningful difference in the lives of our fellow citizens, offering them a sense of stability and dignity during difficult times.

I believe in your ability to rise to this challenge and positively impact our community. As you embark on this journey, remember that you have the full support of your city behind you. Together, we can create a brighter future for our city's residents.

The attached Project Specifications document includes the design challenge, criteria, and constraints that must be followed when designing the temporary shelters.

Thank you for your dedication and commitment to making a difference. I look forward to seeing the innovative ideas and solutions all of you will bring to the table.

With warm regards,
Your Mayor

Project Specifications

City Responsibilities

- The city's utility companies are responsible for the electricity, AC, heat, water, and wastewater for the tiny house community.

Criteria

The floor plan of the tiny house must include:

- a bathroom (sink, toilet, and bathing area (shower or tub))
- a kitchen (sink, fridge, heating/cooking element (microwave, hot plate or stove)
- sleeping area
- living space/room

Your presentation must include three different representations of your team's solution:

- 1 architectural blueprint
- 1 physical model
- 1 virtual model using augmented reality

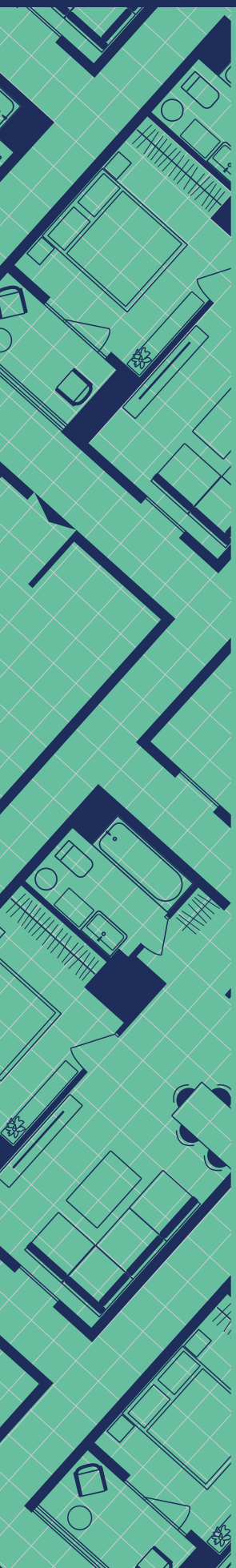
Constraints

- The floor plan of the tiny house cannot be larger than 98 sq ft.
- Two weeks will be given to design an architectural floor plan and build a physical model of the tiny house.
- Three weeks will be given to build a digital 3D model and an interactive 3D model using augmented reality.

Additional Features

Storage can be an issue in a tiny dwelling. If time permits, your team can add:

- at least two innovative storage solutions on the interior and exterior of the house.



LESSON 2

BUILDING A FOUNDATION FOR IMPACTFUL SOLUTIONS

OVERVIEW

LESSON ACTIVATOR

- Activity: Big Ideas Boxes

DESIGN CHALLENGE

- Activity: Identify and Define the Problem
- Activity: Defining a Home
- Activity: Wants vs. Needs

The steps of the Engineering Design Process Addressed in This Lesson:

- Identify and Define the Problem
- Research Ideas and Explore Possibilities

LESSON SUMMARIZERS

- Lesson Summary: discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: encourage students to ask questions about the day's lesson

- Lesson Preview: an overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Identify the problem in the **design** challenge**.**
- Provide examples of what a "home" is through using words and Illustrations.
- Provide examples of how the **engineering design process** applies to real-world situations.
- Differentiate between wants and needs and provide examples and non-examples of each.

VOCABULARY

brainstorm

communicate

constraint

criteria

design

diagram

effectiveness

engineering design process

impact

innovation

model

process

technology

MATERIALS

Facilitator Use

- laptop or desktop
- projector or SmartBoard
- *Building the Future in 3D* slide deck
- 1 thick black marker (facilitator provided)
- 3 sheets of 8.5" x 10" white copy/printer paper (facilitator provided) or make copies of the “Wants vs. Needs” posters (located at the end of this lesson)

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 pen (blue or black)
- 1 personalized *Big Ideas Box* and *Big Ideas Cards*
- *1 Building the Future in 3D* student notebook
- *1 Big Ideas Student Discussion* handout

PREPARATION

Before starting the lesson:

- Ensure the projector, SmartBoard, and laptop/desktop are fully charged and connected to WiFi.

- Take three sheets of copy/printer paper, and with a thick black marker, write the words "WANT" on the first sheet, "NEED" on the second sheet, and "UNDECIDED" on the third sheet. Select three corners of a room and hang one sheet of paper in each corner.
    - Optional: A master set of these three documents is attached at the end of this lesson to make copies.

- Determine if the location in which students attending this program live in a town, city, or village. Inform students that whenever they encounter the word “city” in a document, slide, workbook page, or handout, they can substitute it with either “town” or “village,” depending on where they currently live.

- **Facilitator Note:** Beginning with Lesson 2, if you have limited time, skip the Big Ideas Box *Lesson Activator* activity.

ASSESSMENTS

- Observations: As students complete various activities, note their individual levels of engagement, their ability to think critically, and their ability to **communicate** effectively. Use their responses and observed peer interactions to informally assess their critical thinking abilities and **communication** skills.

- Questioning: Ask probing questions about the design challenge, **criteria**, and **constraints** to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Written Responses: Facilitators should collect and review students' written answers at the end of each lesson. Analyzing written responses can yield valuable insights into students' level of conceptual understanding. This also allows the facilitator to tailor future instruction accordingly to support students' individual learning needs.

LESSON ACTIVATOR

Activity: Big Ideas Cards

1. Welcome students into the class.

2. Display the slide “Big Ideas Cards” (Slide 11). As students enter the class, instruct them to follow the directions on the slide.
    - **Facilitator Tip:** If students finish early, tell them to open their notebooks to the page ”*Big Ideas Peer Discussion Questions*” located in the Appendix. Direct them to use the questions and prompts on this page to help classmates **brainstorm** ideas and possible solutions.

DESIGN CHALLENGE

Activity: Identify and Define the Problem

1. Tell students to sit with their team.. Ask teams to select one Materials Manager who will be responsible for acquiring one *Building the Future in 3D* student notebook and one pencil for each member of their team.
2. Display the slide "Let's Get Started!" (Slide 12). Tell the class that during today's lesson, they will begin to work on finding a solution to the real-world problem by completing Steps 1 and 2 of the **engineering design process**.
3. Display the slide "Define the Problem" (Slide 13). Inform teams they will work together to complete each activity listed on the slide.
    - **Facilitator Tip:** As teams work together, move around the room to ask probing questions and make observations.
4. When teams have finished their activities, conduct a class discussion to review the content. It is also important to help students make connections between the content they just completed and careers.

Activity: Defining A Home

1. Display the slide “Defining a Home” (Slide 14). Inform the class everyone does not experience the same living conditions. For this reason, it is essential they are sensitive and empathetic to their peers throughout the duration of this module, as some of their peers might have or are currently experiencing homelessness, living in poverty, or are in or have been in the foster care system.
2. Have students open their notebooks to the “Defining a Home” page and independently complete the activity.
3. Once all students finish, facilitate a whole class discussion.

Activity: Wants vs. Needs

1. Display the slide “Wants vs Needs” (Slide 15) and invite the class to build their background knowledge related to homelessness. They will complete a “Three Corners Wants vs. Needs” activity.
    - Invite students to walk to each corner of the room with one of the three signs: “Wants,” “Needs,” and “Undecided”.

- After identifying each sign, invite students to move to the corner of the room that best represents their thinking in regard to specific prompts.
- Say the word “candy.” Encourage students to move to the corner of the room that best represents their thinking.
- Once students move to their respective corners, allow students to share their thinking with the class.
- Continue this activity with a variety of other words: water, cell phone, tablet, fruit, sunshine, housing, video game, warm, clothing, etc..
    - **Facilitator Note:** At this time, do not share the definitions of “wants” and “needs”. Rather, invite students to share their thinking to facilitating the **process** of these decisions as a collective group.

* "Habitat for Humanity." What Does Home Mean to You? Accessed [2024], https://www.habitat.org/stories/what-does-home-mean-to-you.

LESSON SUMMARIZERS

1. Summarize: Ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections
2. Student Questions: Encourage students to ask any final questions about the day's lesson
3. Lesson Preview: To build excitement, provide examples of the content and activities students will interact with during the next lesson

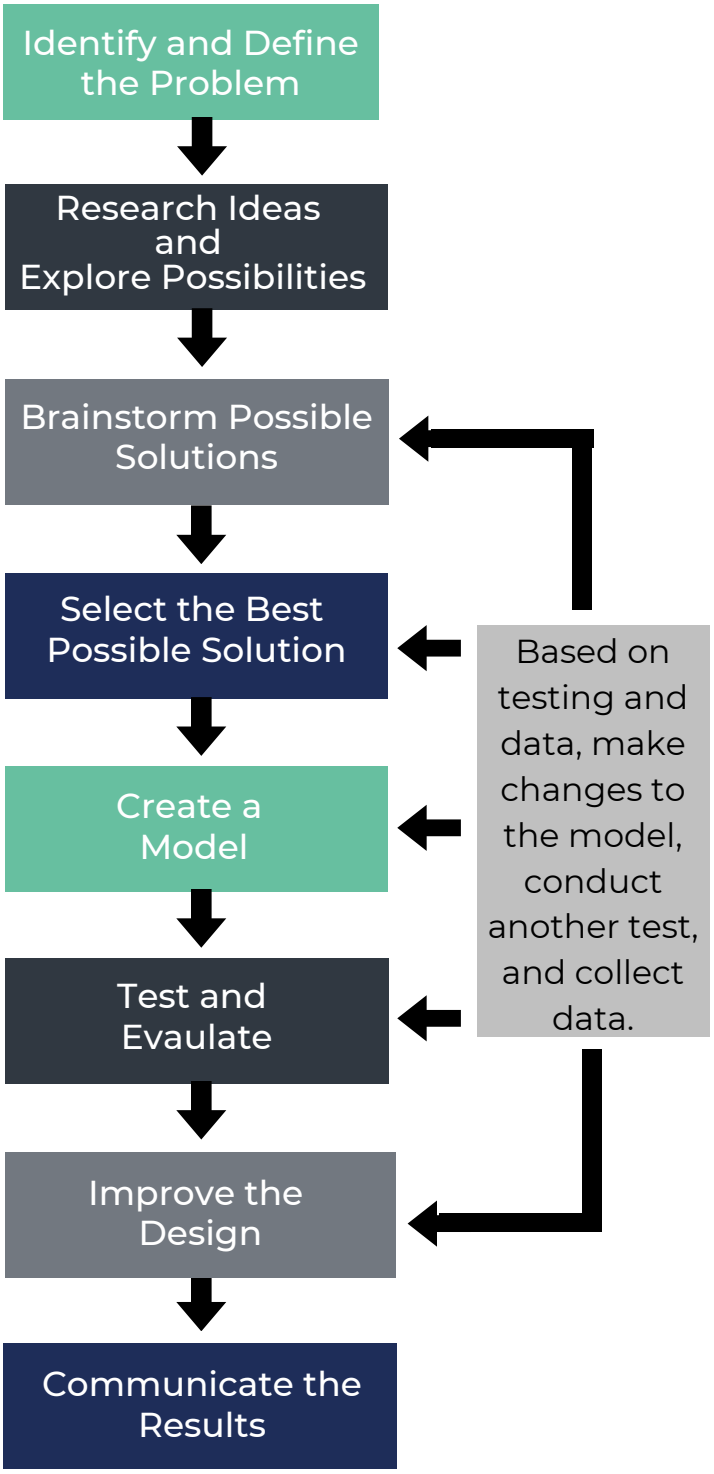
EXTENSION ACTIVITIES

For students who finish early or need a challenge:

- Provide students with additional **brainstorming** prompts to further explore their creativity and problem-solving skills. Encourage students to represent their thinking in both written and pictorial forms.
- Big Ideas Cards: An “Inquiry Helper” role can be assigned to students and will permit them to move around the room, helping peers work on their “Big Idea Cards”. Students help their classmates think through their ideas by asking probing questions.

Engineering Design Process

ARK-Educate



Engineering Design Process

ARK-Educate

Identify and Define the Problem	• What is the problem that needs to be solved? • Who or what population is the design product/solution for? • Why is it important to solve this problem? • What are the design criteria and constraints?
Research Ideas and Explore Possibilities	• Conduct research to identify if existing products or solutions already exist. • Explore who the users or customers were of each product or solution and its strengths and weaknesses.
Brainstorm Solutions	• Generate a list of possible design solutions and technology that could be used to solve the problem. • Withhold judgment to maximize the number of potential solutions.
Select the Best Possible Solution	• Examine and analyze all brainstormed solutions to identify their strengths, weaknesses, and feasibility. • Select one solution, draw an annotated diagram, and create a materials list.
Create a Model	• Build the model (design product) using the annotated diagram and materials list. • If revisions are made to the model during construction, document these changes on the annotated diagram and materials list.
Test and Evaluate	• Conduct a test of the design product. • Document observations, measurements, and data taken during the test. • Evaluate how well the model solves the problem, meets the design criteria, and what improvements should be made to improve the design.
Improve the Design	• Modify the model using the notes, data, and observations collected from the test phase. • If revisions are made, document changes on the annotated diagram and materials list.
Communicate the Results	• Collaborate with team members to determine the best way to summarize the procedure, display the model, and share the results.

Tiny House Design Challenge

Identify and Define the Problem

Directions: Use the “Design Challenge Letter and Specifications Sheet“ to answer the questions below.

1. What is the problem you are tasked with solving?

2. What has your design team been asked to **design**?

3. What population would this solution help and why?

4. Create a list in each category. To learn the definitions of "**criteria**" and "**constraints**" use the "Vocabulary Terms" document located at the back of your notebook.

Criteria	Constraints

Reflect

5. What are you most excited about with this **design** project?

6. What do you think will be the most challenging part of completing this **design** challenge?

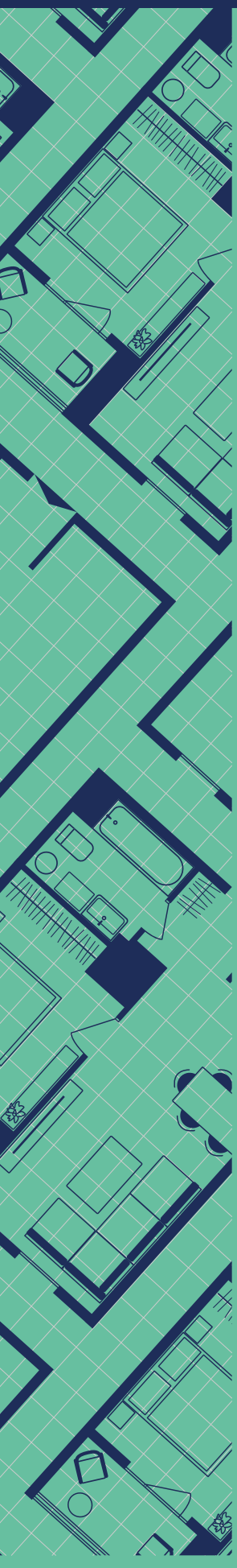
Defining A Home

What does the word “home” mean to you? You can represent your response with words, illustrations, or both.

WANT

NEED

UNDECIDED



LESSONS 3-6

THINKING BIG WITH SMALL SPACES: FROM 2D TO 3D

OVERVIEW

FACILITATOR NOTES

- Lessons 3-6 span four classes for a total of 240 minutes.
- The table below provides an overview of the curriculum structure for Lessons 3-6.

Lesson 3	Lesson 4	Lesson 5	Lesson 6
Lesson Activator Activity: Big Ideas Boxes	Lesson Activator Background Building + Activity: Tiny House Newsletter, Video Clips	Lesson Activator Activity: Big Ideas Boxes	Lesson Activator Activity: Big Ideas Boxes
Design Challenge			
Lesson Summarizers			

LESSON ACTIVATORS

- Lesson 3, 5, and 6 - Activity: Big Ideas Box
- Lesson 4: Background Building + Activity: Tiny House Newsletter, Video Clips, Research Ideas, and Explore Possibilities Step of the **Engineering Design Process**

DESIGN CHALLENGE

Lessons 3-6

Designing Architectural Blueprints and Building A Physical Model

- Activity: Designing Individual Floor Plans
- Activity: Team Blueprint Final Design
- Activity: Phase One: Team Construction (physical build of the tiny house)
- Activity: Phase Two: Team Home Staging

The Steps of the Engineering Design Process Addressed in These Lessons:

Floor Plan Blueprint

- Research Ideas and Explore Possibilities
- Brainstorm Possible Solutions
- Select the Best Possible Solution
- Create a Model
- Test and Evaluate

Physical Model

- Brainstorm Possible Solutions
- Select the Best Possible Solution
- Improve the Design
- Create a Model
- Finalize Model
- Test and Evaluate

LESSON SUMMARIZERS

- Lesson Summary: Discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: Encourage students to ask questions about the day's lesson
- Lesson Preview: An overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Develop skills in creating **architectural blueprints** using the **criteria** and **constraints** outlined in the design challenge.
- Identify why teams must **communicate**, share ideas, and divide tasks to complete a **design** solution.
- **Brainstorm**, **design**, and create **2D architectural blueprints** and **3D** models using the **criteria** and **constraints** outlined in the design challenge.
- Evaluate and adapt **architectural blueprints** and **3D** models using the **criteria** and **constraints** outlined in the design challenge.
- Explain the importance of **innovation** and the purpose of this design challenge.

VOCABULARY

2D (two-dimensional)

3D (three dimensional)

architectural blueprint

augmented reality

brainstorm

communicate

constraint

criteria

design

effectiveness

engineer

engineering design process

function

impact

innovation

model

plan

process

refine

reflect

technology

test

tool

MATERIALS

Facilitator Use

- laptop or desktop
- projector or SmartBoard
- *Building the Future in 3D* slide deck

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 personalized *Big Ideas Box* and *Big Ideas Cards*
- 1 pair of scissors
- 1 *Building the Future in 3D* Student Notebook
- 1 glue stick
- 1 clear ruler
- 1 *Big Ideas Student Discussion* handout

Per Team

Materials are provided for five teams, each with four students.

- *1 package of crayons*
- *1 package of thin markers*
- *1 Tiny House Living Newsletter*
- *1 Designing and Building A Tiny Home Architectural Blueprint* packet

PREPARATION

Before the start of this lesson:

- "During this section of the module, if you find teams need additional time to build their tiny house, it is suggested to skip the Lesson Activator activities identified for Lessons 5-6.
- Ensure the projector, SmartBoard, and laptop/desktop are connected and working correctly.
- Each day, display the slide "Thinking Big With Small Spaces: From **2D** to **3D** Models" (Slide 16) when students enter the room.
- It is essential to watch both videos on Slide 18 before the start of the lesson. You will need to scroll through commercials and choose "full screen" mode to hide other advertised videos. In the lesson, specific viewing timeframes are provided for each video.
    - Video: Ingenious Tiny Home

      "21 Year Old's Ingenious £5,000 Tiny Home!" YouTube, Living Big In A Tiny House, 27 Oct. 2023

      https://youtu.be/4I14QzRY8BI?feature=shared
    - Video: Urban Living in a Tiny House

      "Our Urban Tiny House in New Zealand." *YouTube*, Living Big In A Tiny House, 24 May 2019,

      https://youtu.be/LvGXer4NsEw?feature=shared&t=2

- In the *Designing and Building Tiny Homes Architectural Blueprint* packet, a sheet of blank white paper is provided for the land the tiny house is placed upon. As the facilitator, you can elect to substitute this sheet of white paper for construction paper colors in the shades of green, brown, gray, or cream.
    - **Facilitator Note**: Review the *Lessons 3-6 Thinking Big With Small Spaces* training video to see examples of land replacement ideas.

- While reviewing the *Designing and Building Tiny Homes Architectural Blueprint* packet address the single and double burner hot plate icons as these kitchen components may not be common knowledge. Explain that hot plates are similar to a stove top that only use counter space as they do not have an oven underneath.

ASSESSMENTS

- Observation: Observe students as they work in teams to create the **architectural blueprint** of the floor plan. Take note of their collaboration, creativity, and adherence to the given **criteria**.
- Questioning: Ask students to explain their **design** choices and how they **plan** to address the **constraints** provided. This will help assess their understanding of the principles of the **engineering design process**.
- Peer Feedback: Encourage students to provide constructive feedback to their teammates during the **architectural blueprint** creation **process**. This will assess their ability to evaluate designs and promote teamwork and **communication** skills.
- Blueprint Evaluation: Review each team's **blueprint** for completeness and accuracy, ensuring proper dimensions and essential components are included.
- Model Inspection: Examine the physical **models** built by teams based on their **architectural blueprints**. Assess the **effectiveness** of their problem-solving skills to transform **2D plans** into **3D models**.

- Reflection: Have students **reflect** on the challenges faced during the **design** and building **process**. Ask them to identify areas of improvement and share what they have learned through this hands-on activity.
- Defining a Home: Use this as an informal assessment to gauge students' conceptual understanding of what defines a “home.”

LESSON ACTIVATORS

Lessons 3, 5, and 6 - Activity: Big Ideas Box

1. Display the slide "Lesson Activator Activity: *Big Ideas Box*" (Slide 17). As students enter the class, instruct them to follow the directions on the slide.
    - **Facilitator Tip**: If students finish early, tell them to open their notebooks to the page "Big Ideas Peer Discussion Questions" located in the "Appendix." Direct them to use the questions and prompts on this page to help classmates **brainstorm** ideas and possible solutions.

Lesson 4 - Background Building: Tiny House Newsletter and Video Clips

1. State the following to the class, *Last week, we learned about the first step of the **engineering design process**. Turn and talk to your partner about that step and what it involves. Feel free to use your notebook as a reference **tool**.*
2. Then say, today, you will learn about the second step of the **engineering design process**, *Research Ideas and Explore Possibilities.*

- Have students open their notebooks to the “Research Ideas and Explore Possibilities” and “Research Ideas and Explore Possibilities Continued” pages.
- Display the slide “Research Ideas and Explore Possibilities” (Slide 18). Tell the class that they will read an “ARK Adventures: Tiny House Living Newsletter”, watch two videos and view one website to build their background knowledge before they begin to **design** their tiny house. While they are doing so, students will determine what notes to document as part of their research.

3. Give each team one “Tiny House Living Newsletter.” Tell teams they will read the newsletter together and determine what information to record in their notebooks.

4. Next, invite teams to watch a tiny house video. Inform students although they will create a basic tiny house, this video contains additional tiny homes features they will not use for this challenge; however, this video will build their background knowledge and inspire creativity.

- **Facilitator Tips**: Before playing the “Ingenious Tiny House” video (Slide 18), refer to the “Lesson Preparation” section for video viewing guidelines. The entire video is 18 minutes and 23 seconds long. It is suggested that the following be played:
  - 3:37-3:45 Discusses the size and **design** of the tiny house
  - 5:25-6:11 composting on the exterior
  - 6:16-8:00 interior **design**, **function**, and storage features
  - Additional video sections can be viewed if they apply to the real-world design challenge. If students need additional time to take notes, playing the video clip a second time is suggested.

5. Play the second video clip from the “Research Ideas and Explore Possibilities” (Slide 18). Inform students although they will create a basic tiny house, they will view a tiny house with additional features they will not use. This video will build their background knowledge and inspire creativity.

- **Facilitator Tips:** Before playing the video, “Urban Living in a Tiny House,” refer to the “Lesson Preparation” section for video viewing guidelines. The entire video is 16 minutes and 46 seconds long; however, it is suggested that the following be played:
    - 0:27 - 4:40 Discusses the size of the tiny house and its design
    - 6:18-6:50 Storage (*remind students that they will not have stairs; however, this is an idea for creative storage)
    - 8:03-8:48 Additional storage and office space
    - 9:10-9:50 Storage and storage loft (teams may be able to add a storage loft in their build if they get creative)
    - 10:02-10:32 Bathroom design
    - You can play additional video sections if they apply to the real-world design challenge. If students need additional time to take notes, playing each video clip a second time is suggested.

DESIGN CHALLENGE

Lessons 3-6 Designing Architectural Blueprints and Building A Physical Model

1. Design Challenge: How can we **design** a functional and **innovative** tiny house to address the housing challenges in our community?

2. Tell the class,

   "*In your design teams, you will need to **design** an **architectural blueprint** for your tiny home solution that meets specific **criteria**. and pushes the boundaries of a typical tiny house design. Your task is to create a functional living space for a homeless individual and also showcase your design team's creativity in maximizing every square foot.*

   *Guided by the **criteria** and **constraints** in the design challenge, you will **brainstorm**, sketch, and **refine** your team's **blueprints** until you are confident that the **architectural blueprint** will successfully solve the task of designing a 98-square-foot tiny house. From envisioning the layout of essential areas to devising innovative storage solutions, your*

designs will pave the way for a new era of compact and thoughtful temporary housing solutions."

3. Display the slide "*One Architectural 2D Blueprint*" (Slide 19). Inform teams the parts in the photo are the components each team will get to build their tiny house.
    - Take a moment to review the definition of **2D**.

4. Display the slide "*One Physical 3D Model*" (Slide 20). Tell the class this is what their build will begin to look like once they assemble each part. Emphasize each team's build should not look like the example on the slide; rather, it is displayed to provide inspiration for what they are going to work on.
    - Take a moment to review the definition of **3D**.

5. Display the slide "Scale in Design"(Slide 21). Explain **scale** shows how big something is in a drawing or **model** compared to real life. Highlight the importance for making sure everything is the right size and fits together properly. Discuss how the concept of **scale** will be used in their **design**.

6. Ask students to open their notebooks to the “Independent Rough Draft #1” page. Tell students the grid in their notebooks will be used for their **scale**.

7. Ask students to return to the “Mayor’s Specification Sheet” to locate how many square feet are needed for the floor plan (98 sq ft).

8. Display the slide “Determining Area” (Slide 22). Review the content on the slide. Ask students to count the number of squares in the length of the floor plan (14 squares) and to count the number of squares in the width of the floor plan (7 squares).

9. On a blank space on their “Independent Rough Draft #1” page, encourage teams to calculate the area of the floor plan (14 sq ft x 7 sq ft = 98 sq ft).

10. Ask students to return to the “Mayor’s Specification Page” and locate the required components to include in the interior of the floor plan (sleeping area, bathroom, small kitchen, and living space/rooms) and the additional features (innovative storage solutions) to be added if time permits.

Facilitator Notes:

- The sleeping area can be in its own space or built into an existing space (e.g., a pullout bed that serves as a couch during the day).
- The bathroom must contains a sink, toilet, and area to bath. This could be a shower, tub or both.
- The kitchen must contain a sink, a fridge, and a method to heat/cook food (microwave, hotplate, stove, etc.). It does not require a dishwasher, a large version of appliances, or multiple ways to heat/cook food.
- The living space/room can be a dedicated space but does not have to be. The space can serve multiple purposes.

11. Display the slide “Floor Plan Essentials and Additional Components” (Slide 23). Ask students to open their notebooks to the “Floor Plan Essential Components” page. Give teams approximately five minutes to create a list of essential items for each space. Facilitate a class discussion to ensure all teams have the same information:

Small Kitchen	Bathroom	Sleeping Area	Living Space/Living Room
• counter • sink • small fridge • hot plate • microwave	• sink • toilet • bathing area (tub or shower) • wall to separate bathroom from living space	• bed	• couch/ • love seat • table • chair • lamp

12. Ask students to open their notebooks to the "Floor Plan Additional Components" page. Give teams approximately five minutes to create a list of items that are not required for a temporary living space but would be nice to have.

13. Tell the class that you are not going to hold a whole class discussion about these items as these are the components that will help set their tiny home solution apart from each other. Here are some examples of additional components:

Small Kitchen	Bathroom	Sleeping Area	Living Space/Living Room
• rug • plant	• tub	• bedside table • storage for clothing • lamp	• coffee table • side table • rug • plant • television • television table • desk

14. Invite students to open their *Building the Future in 3D* notebooks to the "Brainstorm Possible Solutions" page.
    - Inform teams they will use this page to guide their team through the steps needed to create **2D architectural blueprint** drafts of a floor plan.
    - The goal of this **process** is to create several versions of a floor plan.

15. Hand each team an *ARK Adventures: Designing and Building Tiny Homes Blueprint Template* packet. Give teams a few minutes to look through each page. Tell the class they will need to use the formula for "Area" to determine the area of each component they want to add to their floor plan.

Display the slide "Measurements Tiny House Components" (Slide 24). Discuss the slide's content, as it will teach teams how to determine the area of each component.

- **Facilitator Tip:** It is suggested the class complete another component measurement to ensure students have a firm grasp of determining area.

16. Display the slide “Ready to get started?” (Slide 25). Students will work in their design teams to **brainstorm** ideas for an **architectural blueprint** that contains a sleeping area, bathroom, living room/space, and kitchen. If extra time permits, teams can **design** innovative storage solutions on the interior and exterior of the house.

    - **Facilitator Tip:** A common misconception to address is assuming that small spaces cannot be functional or comfortable.

    During this time, the facilitator should provide guidance and feedback as they progress, gradually increasing the complexity of the design challenge.

17. After finalizing the team **architectural blueprint**, invite teams to begin Phase One of their tiny home build: Construction. During this **process**, teams should document any revisions made to the **3D** build on the team's **architectural blueprint** in their notebooks.
    - **Facilitator Note:** Remind design teams to conduct a quality check to ensure that their physical **3D** build aligns with their initial **design** vision. Any necessary **refinements** are made to enhance the **model**.

18. When teams complete Phase One: Construction, invite students to begin Phase Two: Staging. Encourage students to use this time to focus on the appearance of the build.

    Facilitate a brief discussion about home staging and why it is important. Encourage students to share ideas about what makes a house a home. Suggestions: color (paint/wallpaper), flooring, "final touches", etc.. Each team's tiny house should be calm and welcoming.

- **Facilitator Note**: Remind students of the **engineering design process** mindset and the importance of paying attention to details and revising as needed to produce a final product that not only meets the **criteria** and **constraints** of the real-world design challenge but is also a **design** they are proud of.

19. After design teams are finished building their **3D model**, students should take out their notebooks, open to the "*Design and Build Reflection Questions*" page, and individually respond to each question. After students have **reflected**, students should share their responses with one another.

If extra time permits, design teams could meet with another team to share their physical **3D models**. During this time, teams would be able to highlight key features of their tiny house that solve the real-world design challenge. Teams can use the feedback from these presentations to improve their **design** solution while they are creating the virtual **3D model** using **augmented reality**.

LESSON SUMMARIZERS

Lessons 3-6

1. Lesson Summary: Ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections

2. Student Questions: Encourage students to ask any final questions about the day's lesson

3. Lesson Preview: To build excitement, provide examples of the content and activities students will interact with during the next lesson

EXTENSION ACTIVITIES

Have students create a digital presentation representing their findings based on one of the following topics:

- Energy-Efficient Systems: Investigate energy-efficient systems and technologies suitable for tiny homes, including solar panels, compact heating and cooling systems, and water-saving fixtures.

- Environmental Impact: Conduct research on the environmental **impact** of tiny homes, including their potential for reducing carbon footprint, energy consumption, and waste generation.

- Sustainable Building Materials: Research and compare different sustainable building materials suitable for constructing tiny homes, such as reclaimed wood, recycled materials, and eco-friendly insulation.

- Tiny Home Living: Conduct research on the pros and cons of tiny home living. Students should be given time to share their presentations with their peers.

Research Ideas and Explore Possibilities

Engineers, **architects**, inventors, and designers conduct research to see if solutions already exist.

Today, you are going to read a nonfiction tiny house newsletter and view several tiny house video clips.

Use the space below and the following page to document details from your research.

FACTS AND DETAILS

DIAGRAMS AND ILLUSTRATIONS

IDEAS AND QUESTIONS

Floor Plan Components
ESSENTIAL

Criteria	ESSENTIAL Components
small kitchen	
half bathroom	
living room/space	
sleeping area	
storage solutions	

Floor Plan Components

EXTRA

Items that are not required for a temporary dwelling but would be nice to have if space is available in the floor plan.

Criteria	EXTRA Components
small kitchen	
half bathroom	
living room	
sleeping area	
storage solutions	

Brainstorm Possible Solutions

Step	Task	Independent or Team Task	Additional Tips and Notes
1	Using the "Tiny House Component Measurements" pages and the "Independent Rough Draft #'s 1-2" templates, design two different rough drafts of a floor plan blueprint for your tiny house solution.	Independent Task	Make sure your designs follow the criteria and constraints on the *Mayor's Specifications Sheet*.
2	Once all team members have completed their rough drafts, share them with each other. Discuss which components of each draft should be used in the final design.	Team Task	Make sure your design team follows the criteria and constraints provided on the *Mayor's Specifications Sheet*.
3	Circle the components on each rough draft your team wants to use for the final team draft.	Team Task	
4	Use the Final Team Draft page to create a final version of your team's blueprint floor plan. Please note: Everyone on the team is responsible for creating the same draft of the final blueprint floor plan in their own notebook, so communication is essential!	Team and Independent Tasks	This draft will be used as a blueprint to create your team's final build.

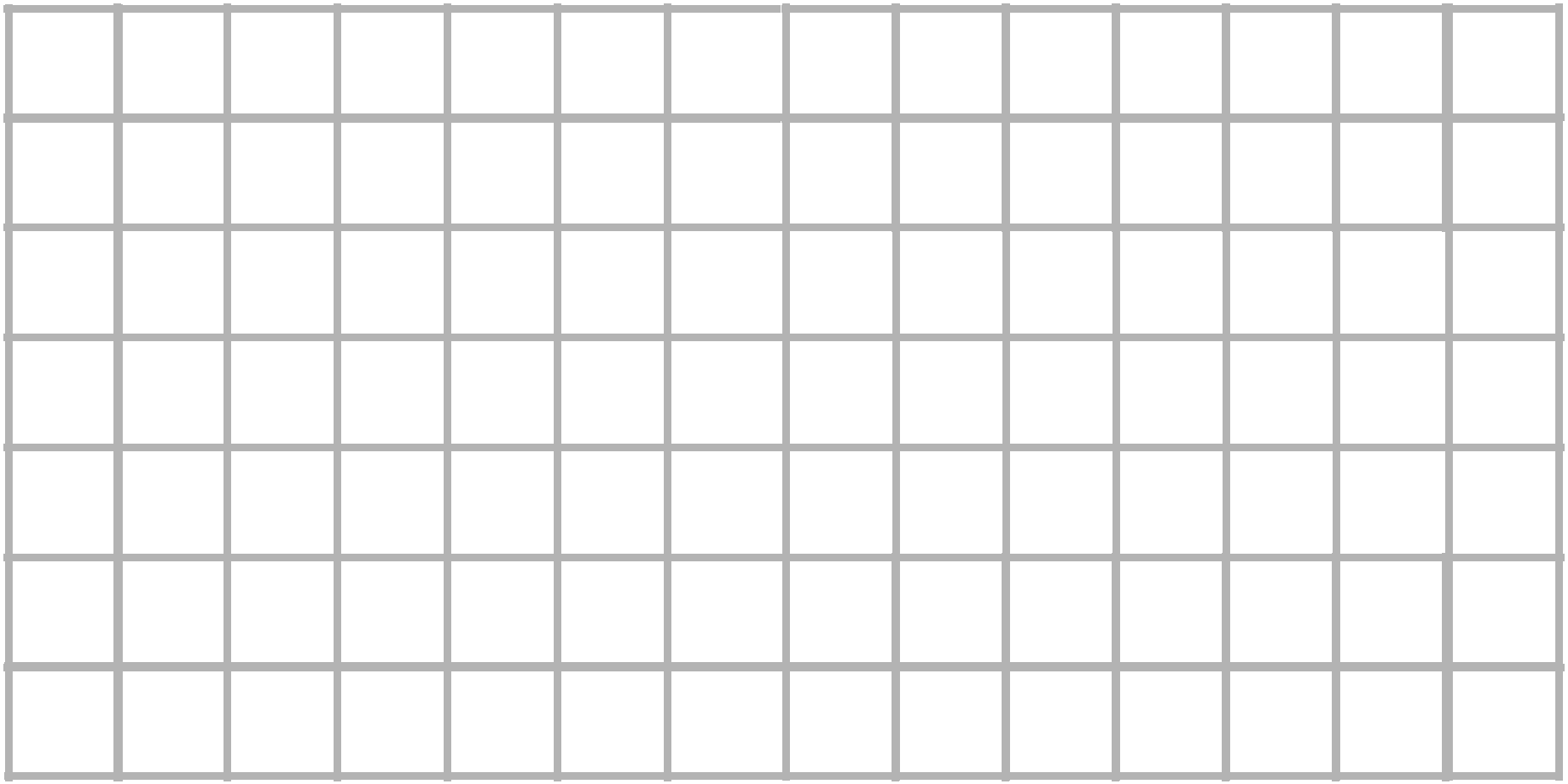
Measurements for Tiny House Components

ROOM AND COMPONENT	LENGTH	WIDTH	AREA
EXAMPLE: Bathroom Sink	2 sq. ft.	1 sq. ft.	2 sq. ft.

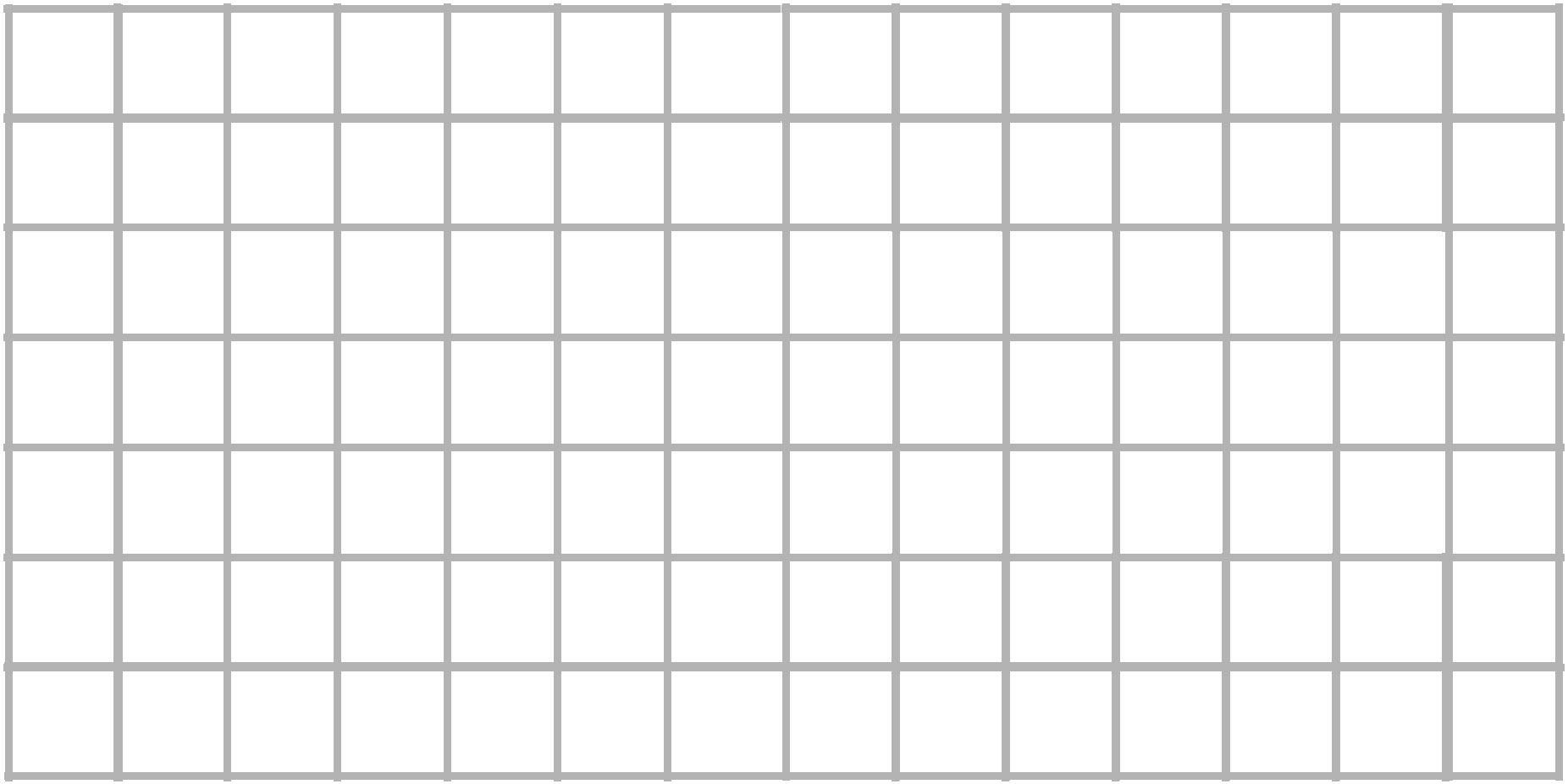
Measurements for Tiny House Components

ROOM AND COMPONENT	LENGTH	WIDTH	AREA

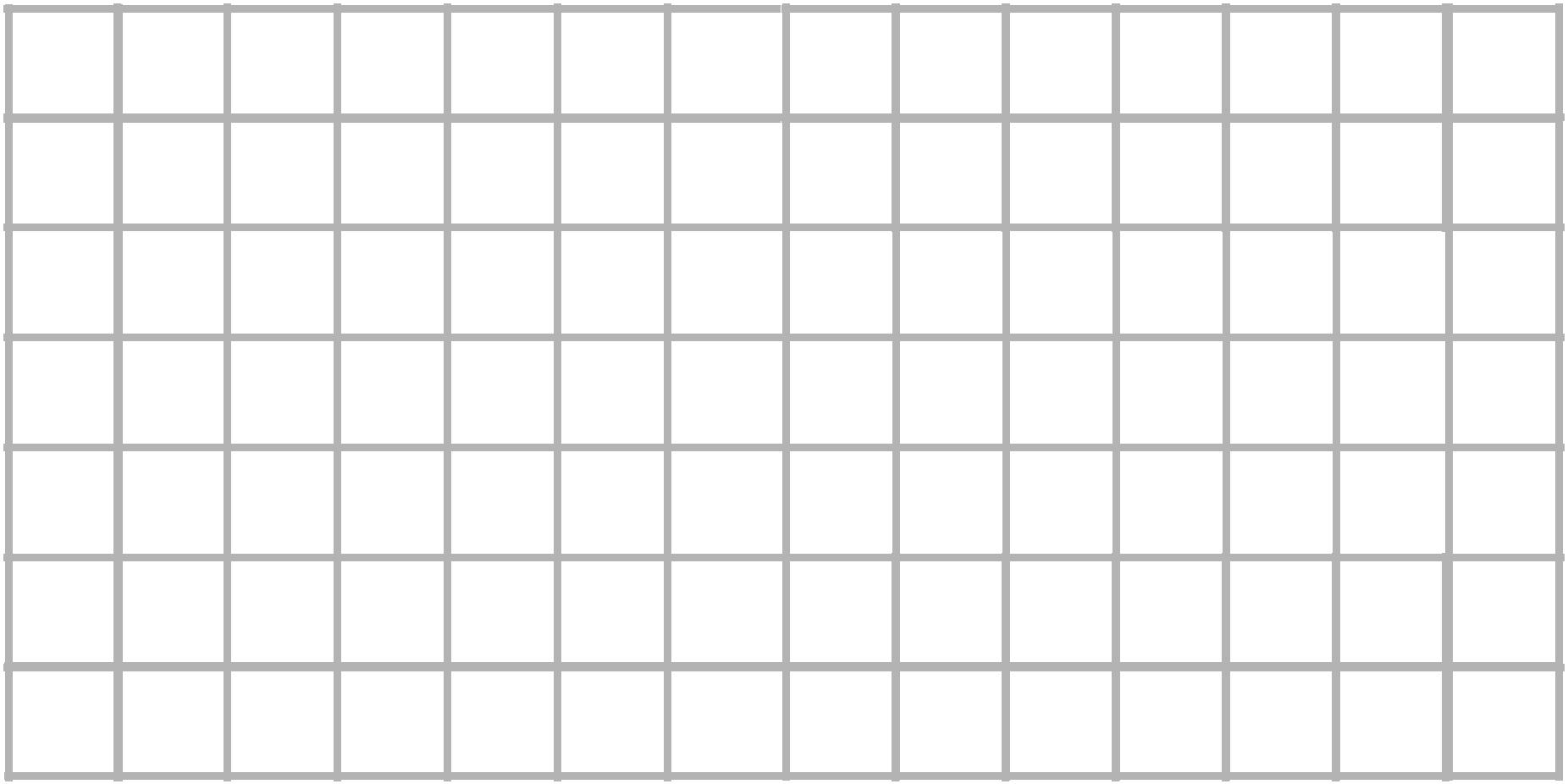
Independent Rough Draft #1



Independent Rough Draft #2



Team Draft



ARK-Educate

Tiny House Living

Quick to Build

Tiny houses can be built much faster than regular houses, which means they can provide shelter to people in need more quickly. This is especially important during challenging times due to national financial issues, when many people may suddenly find themselves without a home.

Typical Size

The typical American home is around 2,600 square feet, and the typical tiny house is between 100 and 400 square feet.

Tiny Homes Can Have:

Bedrooms	Bathrooms	Kitchen
Living Room	TwoFloors	Office
Interior Storage	Exterior Storage.	Lockable Front Door

Tiny Home History

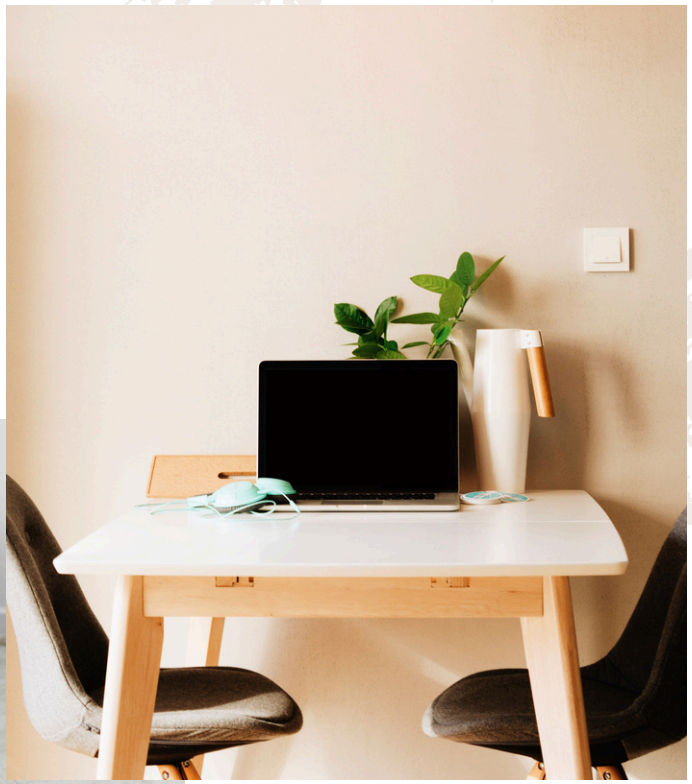
Tiny homes seem like a new trend; however, people have been living in small spaces for centuries.

For example, in the 19th century, settlers on the American frontier often lived in tiny cabins similar in size to modern-day tiny homes. Bathrooms were called outhouses and were located outside of the home.

Many modern-day tiny homes have electricity, AC, heat, a sink with running water, lights, an interior bathroom, a microwave, mini-fridge, and a hot plate.

ARK-Educate

Tiny House Storage Solutions



ARK-Educate

Tiny houses for unhoused individuals give a sense of security, stability, and privacy.

According to the U.S. Department of Housing and Urban Development (HUD*), on any given night in 2022, over 540,000 people experienced homelessness in the United States. This includes individuals, families, and youth.

*https://endhomelessness.org/homelessness-in-america/homelessness-statistics/state-of-homelessness/#key-facts

Tiny House Storage Ideas*

Image Source: shanty2chic
Mirror Shelf Storage

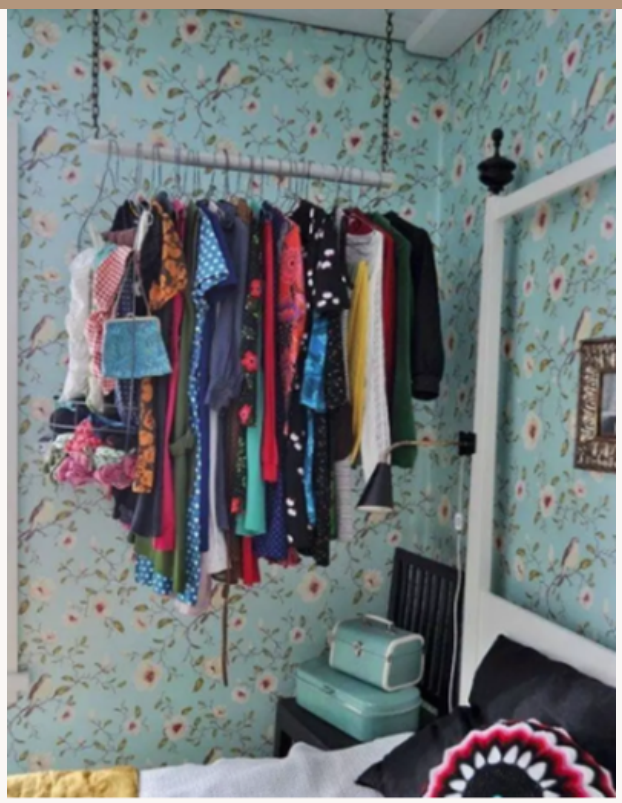


Image Source: Buzzfeed
Hanging Closet

Image Source: Treehugger
Under the Bed Storage

*https://www.tinysociety.co/articles/smart-tiny-house-storage-ideas/, Tiny House Society 7/31/23

Image Source: Treehugger
In the Floor Storage

Image Source: smud
High Shelf and Under the Couch Storage

Image Source: tinyhouseblog
Under the Bed Storage

Image Source: architectural digest
In the Floor Storage

Image Source: tinyhouse.heininge
Tub Shelf

*https://www.tinysociety.co/articles/smart-tiny-house-storage-ideas/, Tiny House Society 7/31/23

BUILDING THE FUTURE IN 3D

DESIGNING AND BUILDING TINY HOMES

ARCHITECTURAL BLUEPRINT PACKET

Assembly Directions

Materials

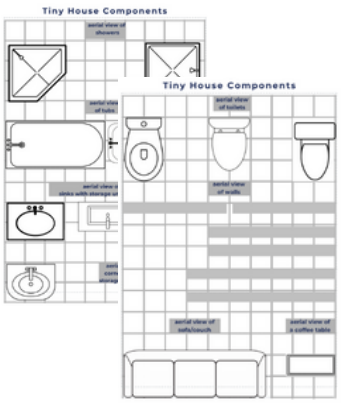
Per Team Member

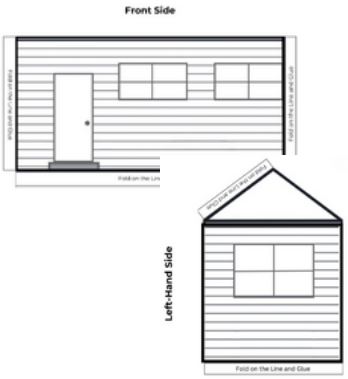
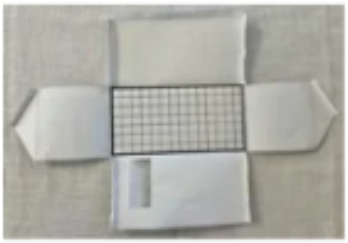
- 1 pencil
- 1 glue stick
- 1 pair of scissors
- 1 clear ruler

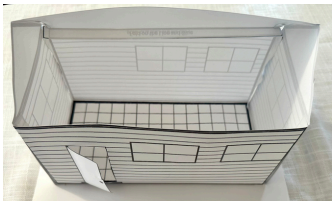
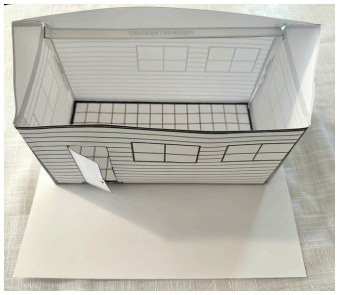
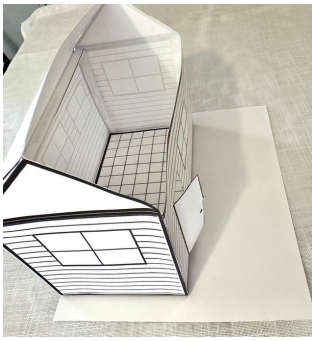
Per Team

- 1 package of crayons
- 1 package of thin markers

It is important that all members of the team participate in the activities listed below.

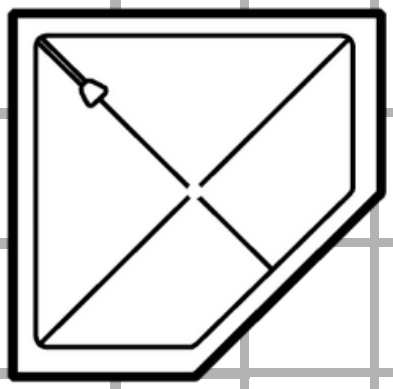
1.	First, locate the components on pages 5-10 that your team wants to use for their floor plan. • **Tips:** ◦ Items on the *Tiny House Extra Components* page (page 11) should only be used after the essential components have been added to the floor plan. ◦ The *Tiny House Components Design Page* (page 12) is provided in case there is an item your team cannot find on one of the *Tiny House Components* pages and you would like to design your own item. Next, color each component. Then, carefully cut out each component and place them onto the *Team's Final Floor Plan Blueprint* document (page 4).	 

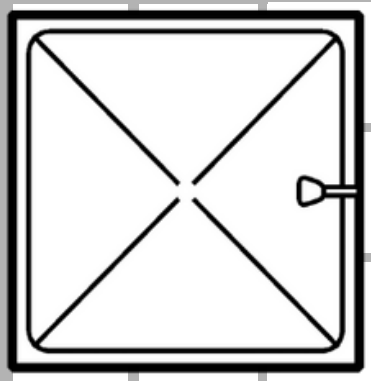
	• **Tip:** During this step, do not glue components onto the floor plan. Leaving components free of glue will allow your team to move items around. Once your team decides upon the final placement of each item, glue them onto the *Team's Final Floor Plan Blueprint document* (page 13).	
2.	Using pages 15-21, cut out the floor plan, front side, back side, left-hand side, right-hand side, and roof templates. • Keep the land page as it is (page 21).	
4.	If your team decides you would like the front door to open, cut the top, bottom, and right-hand side of the door. Place the front, back, right-hand, and left-hand sides next to the appropriate locations on the floor plan. Then, glue each tab of the front, back, right-hand, and left-hand sides to the bottom of the floor plan (the side of the floor without the grid).	 

5.	Design and color all exterior walls as your team deems appropriate. **Optional:** To give your tiny house a realistic feel, trace the windows on the interiors of each wall. Then, design and color the interior walls as your team deems appropriate.	
6.	Glue each side of the front, back, right-hand, and left-hand sides to one another. Then, glue the roof to the back, right-hand and left-hand sides of the house.	
7.	Take out the page titled “Land” (page 21). Flip over the house and add glue to the bottom. Place the tiny house onto the land. • **Tip**: Glue the tiny house toward the back of the land page, so your team has more space in the front of the tiny house to add components like stairs, storage solutions, and other yard items.	 

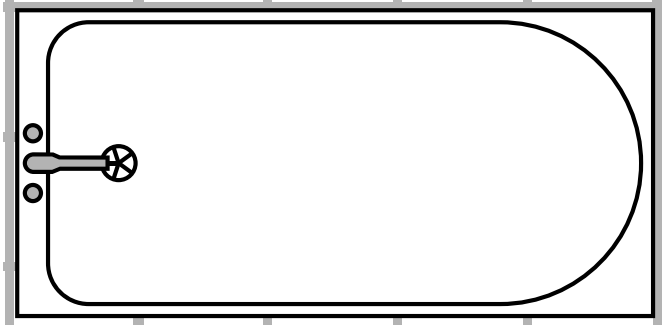
Tiny House Components

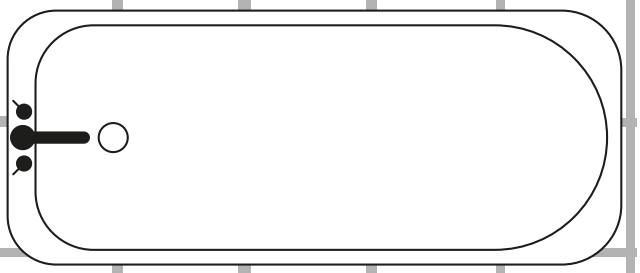
aerial view of showers



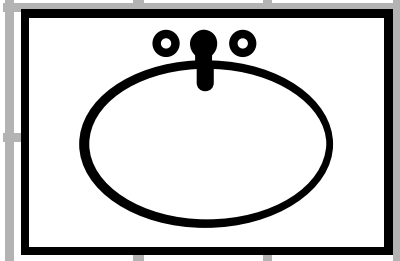


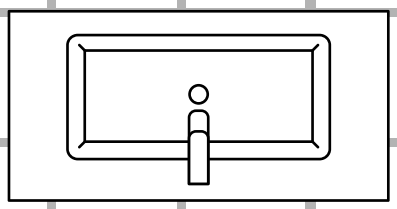
aerial view of tubs

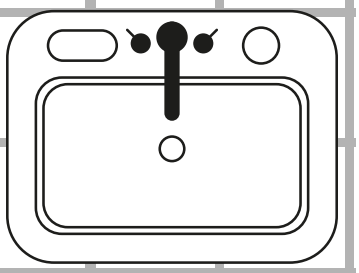




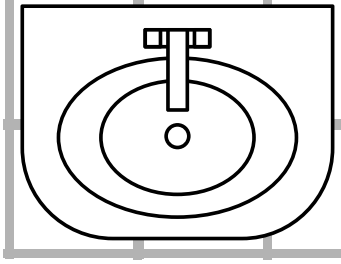
aerial view of sinks with storage underneath

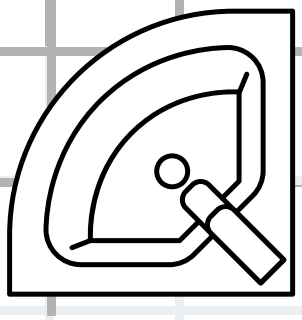






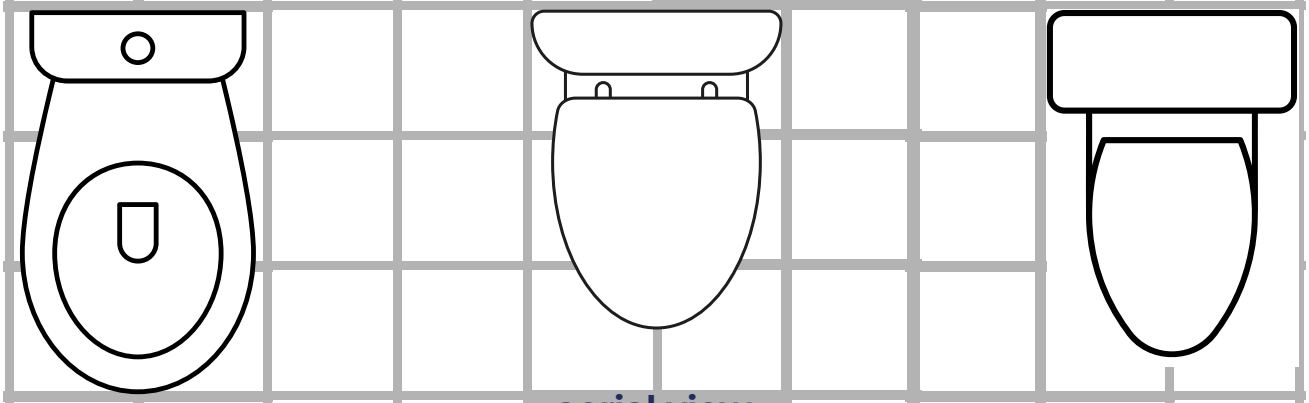
aerial view of a corner sink with storage underneath





Tiny House Components

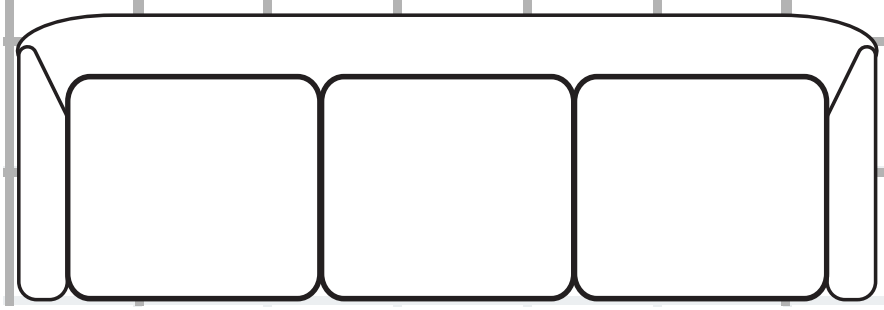
aerial view of toilets



aerial view of walls

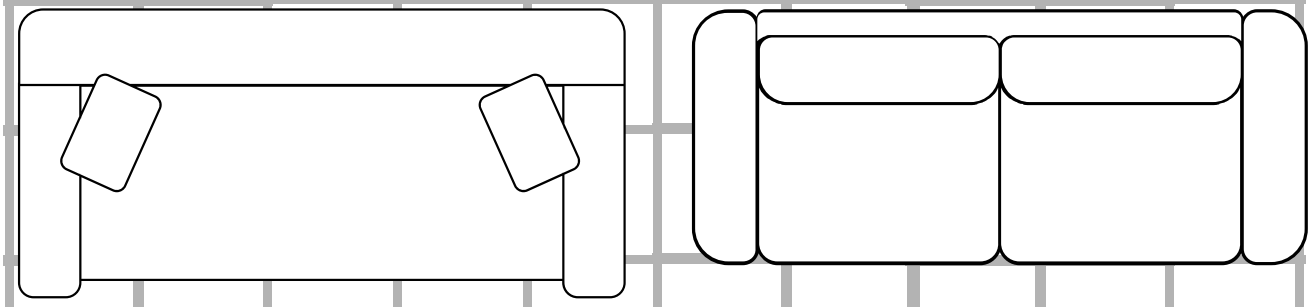
aerial view of sofa/couch

aerial view of a coffee table

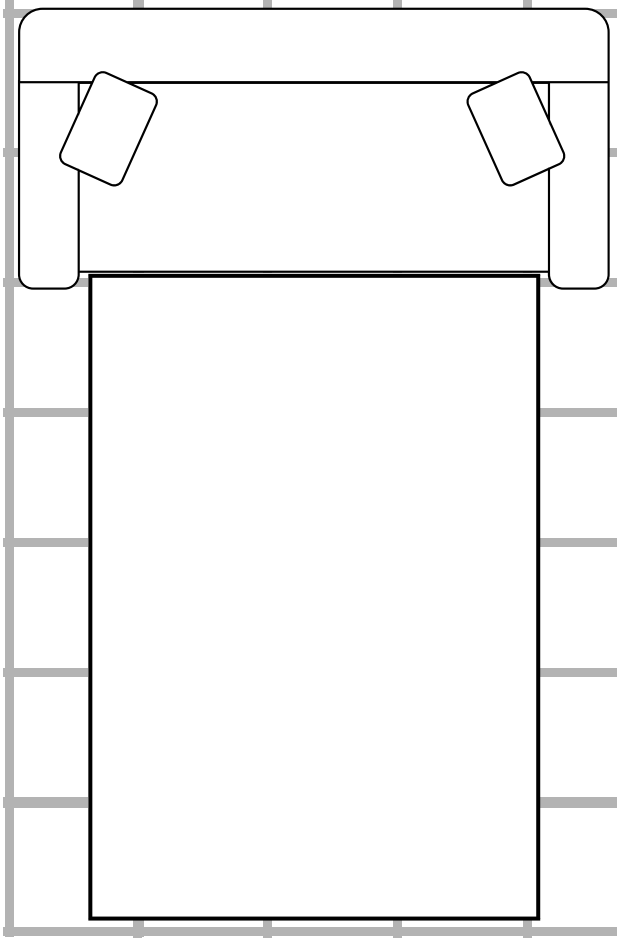


Tiny House Components

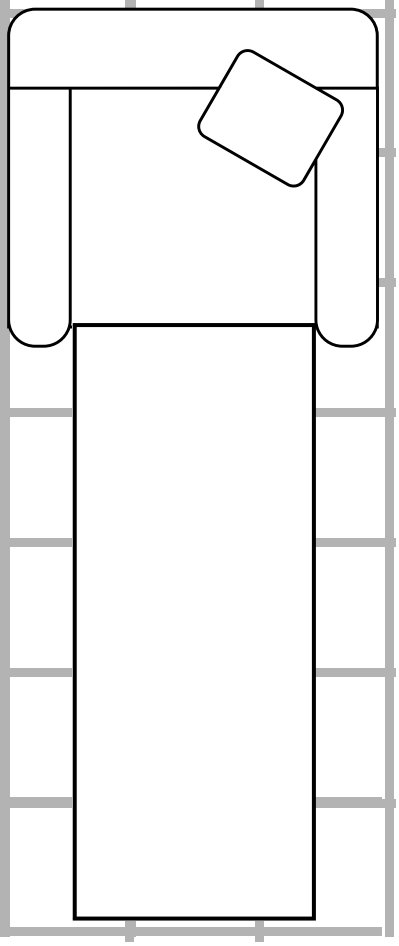
aerial view of love seats



aerial view of love seat sleeper with pull-out bed

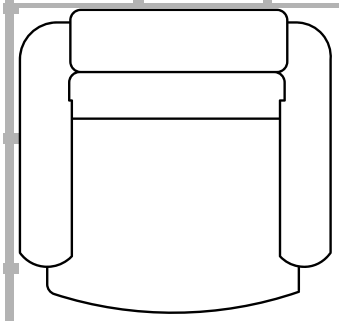


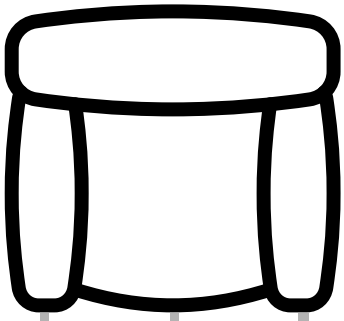
aerial view of sleeper chair with pull-out bed

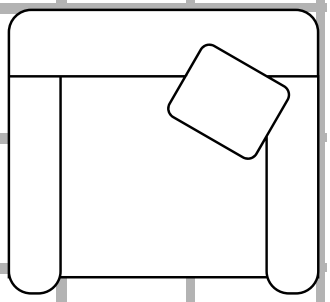


Tiny House Components

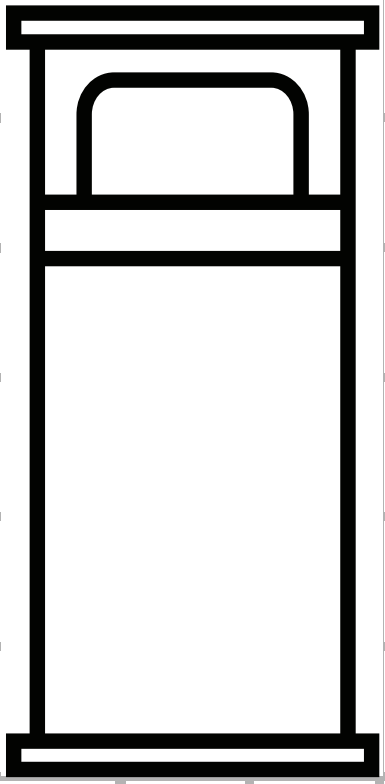
aerial view of chairs

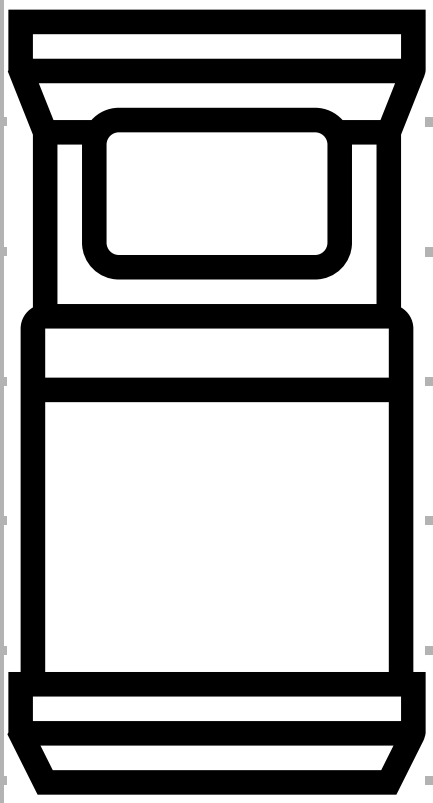




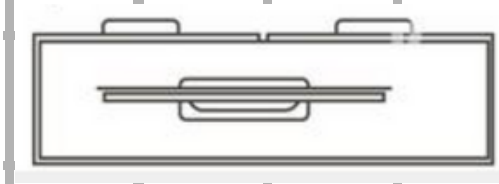


aerial view of twin/single beds



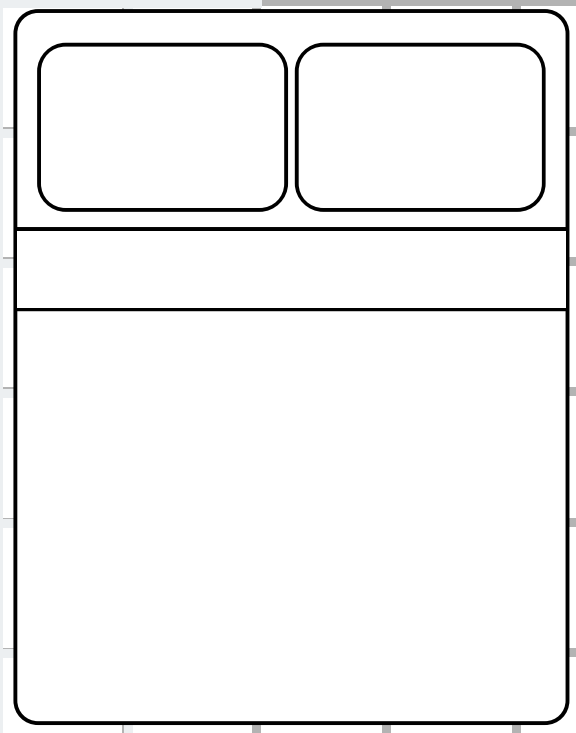


aerial view of tv stands with cabinets for storage

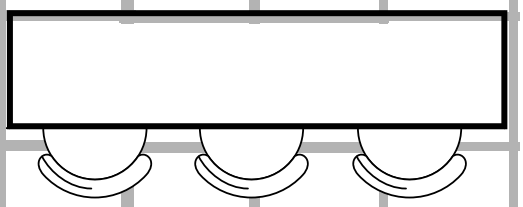


Tiny House Components

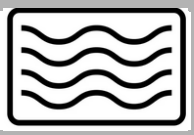
aerial view of full/double bed



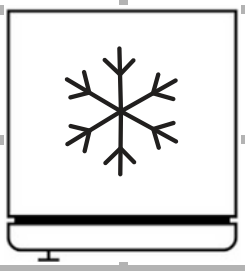
aerial view of counter with stools



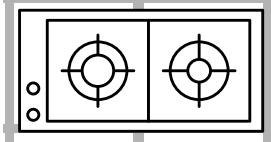
aerial view of microwave



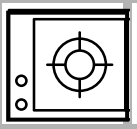
aerial view of compact mini fridge with freezer



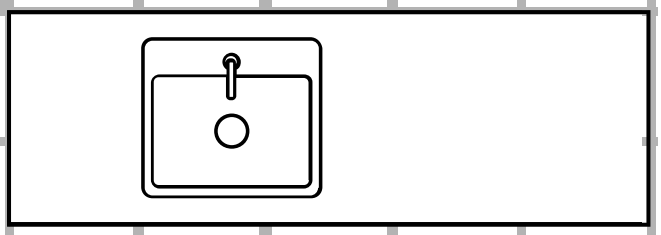
aerial view of two burner hot plate (no oven)



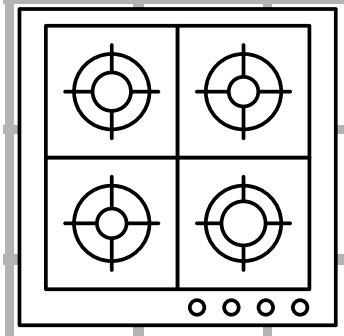
aerial view of single burner hot plate (no oven)



aerial view of kitchen sink with counter and storage underneath

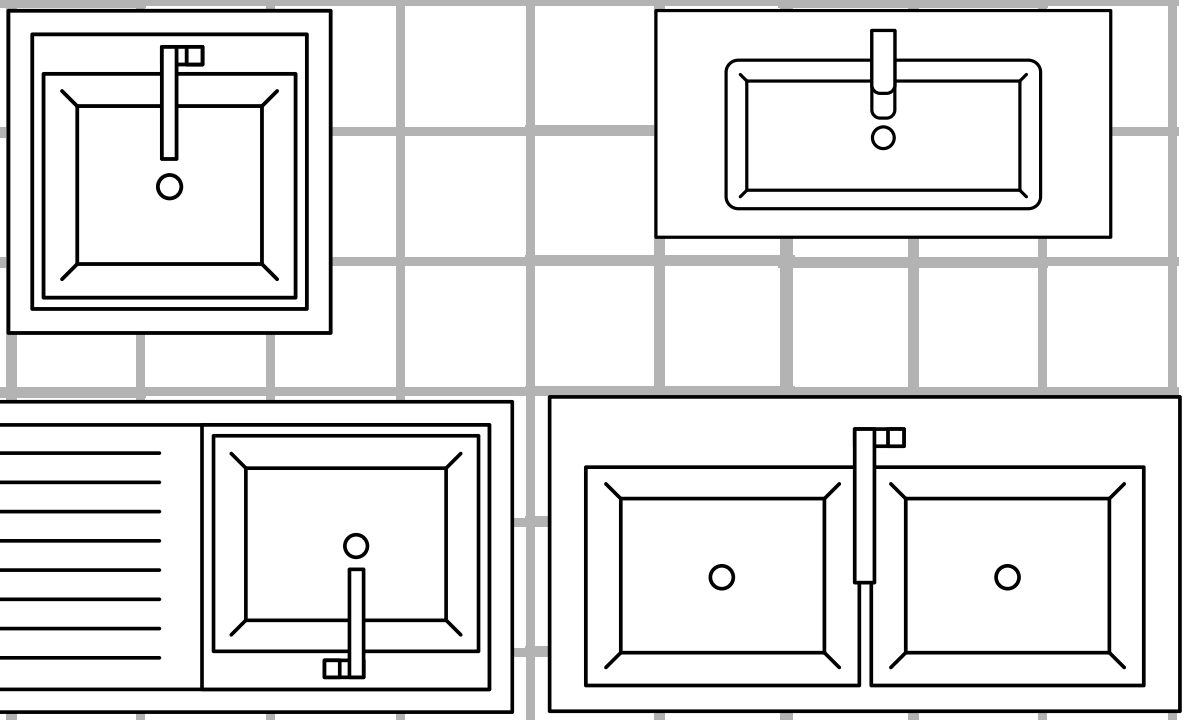


aerial view of four burner stove and an oven underneath

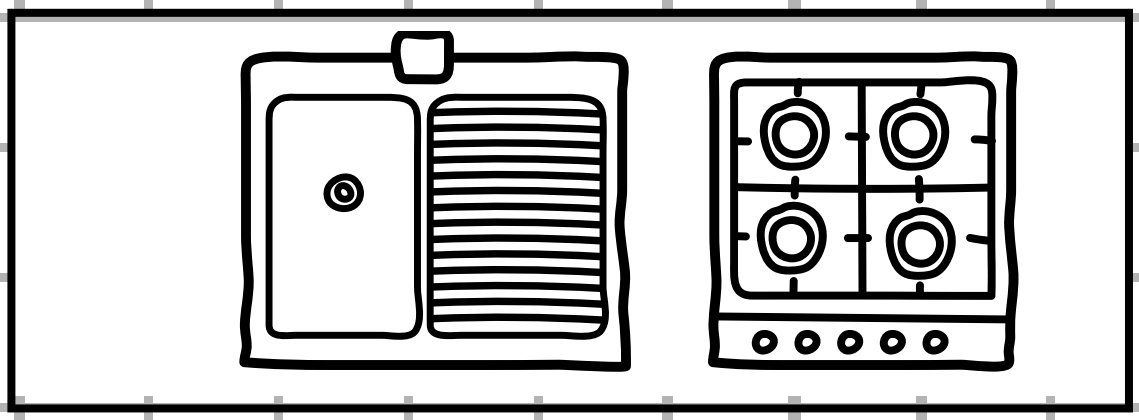


Tiny House Components

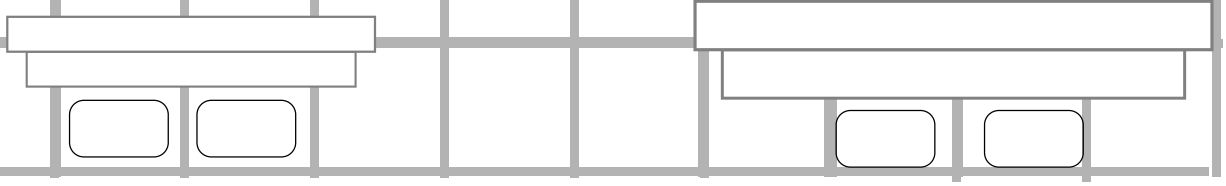
aerial view of kitchen sinks



aerial view of kitchen sink with a four burner stove, oven, a counter, and storage underneath

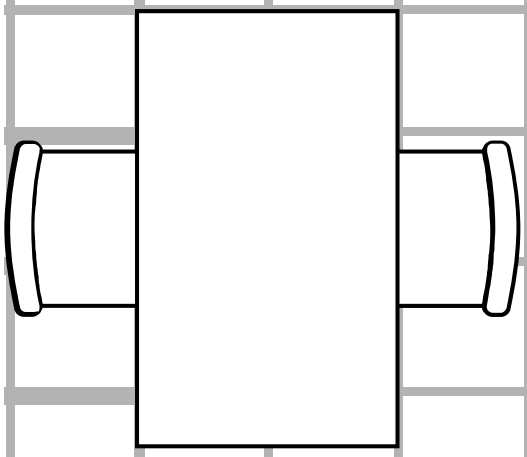


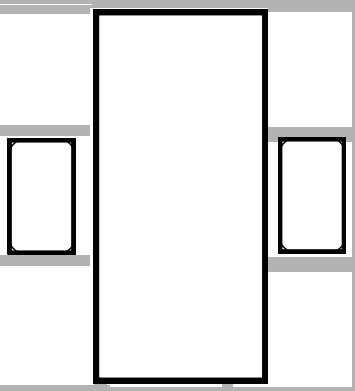
aerial view of counters with stools



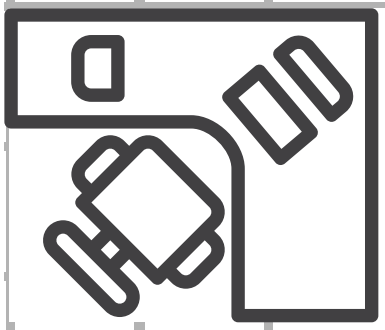
Tiny House Extra Components

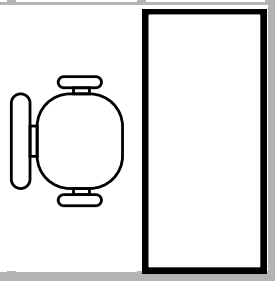
aerial view of tables and chairs



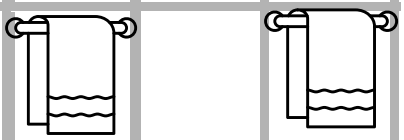


aerial view of desks and office chairs

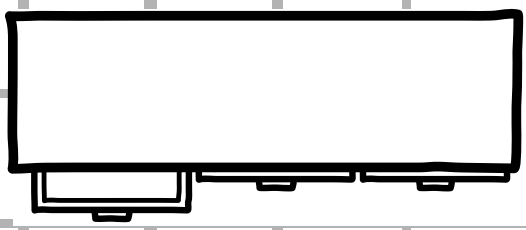




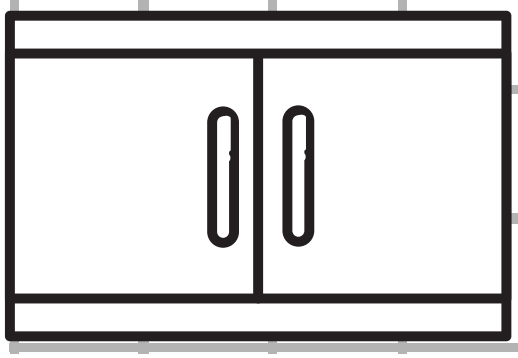
towel racks



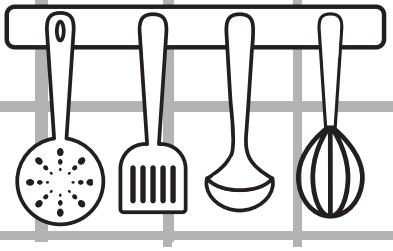
aerial view of a dresser with drawers



wall cabinet



aerial view of wall hanger for kitchen

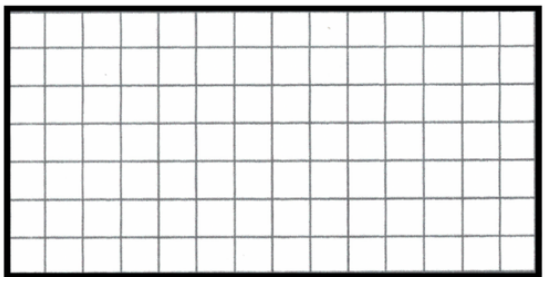


Tiny House Components Design Page

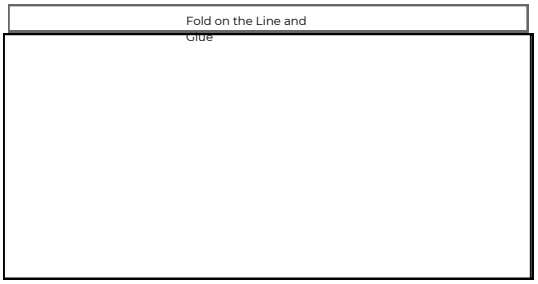
Final Team Floor Plan

Tiny House Rough Draft Blueprint Templates With Siding and Windows

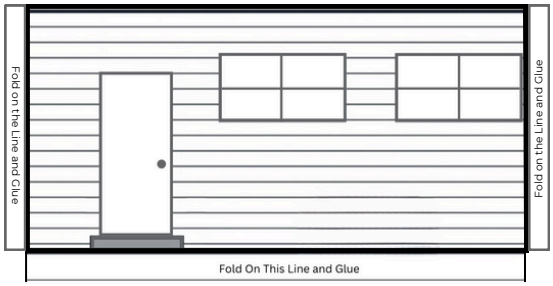
Floor Plan



Roof

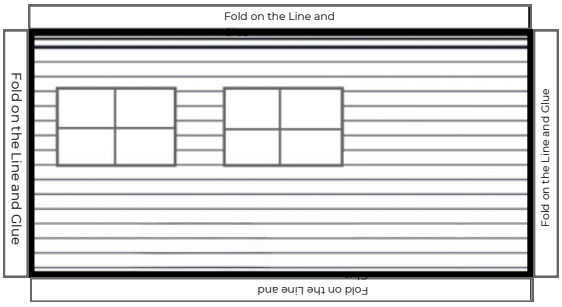


Front Side



Left Side

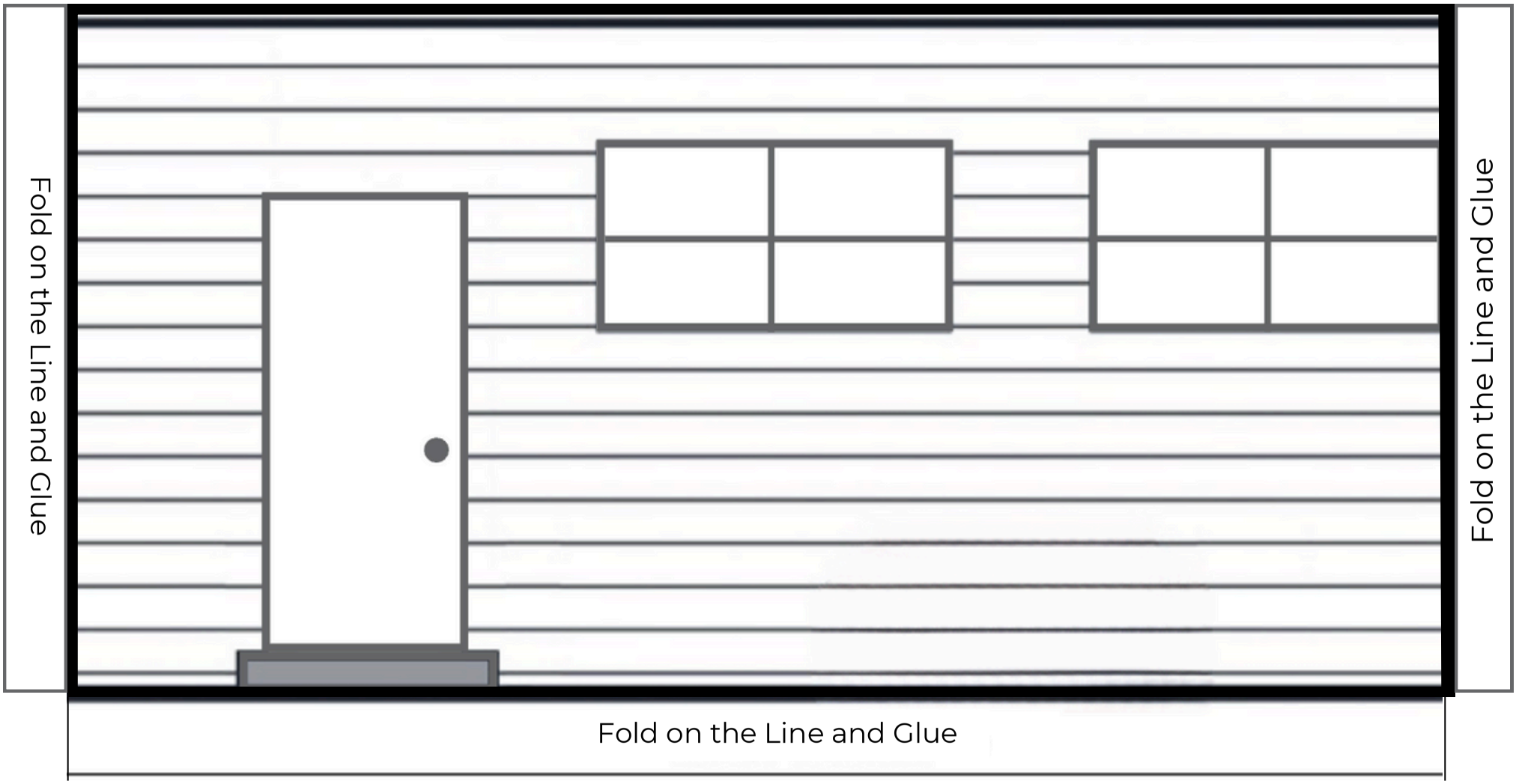
Back Side



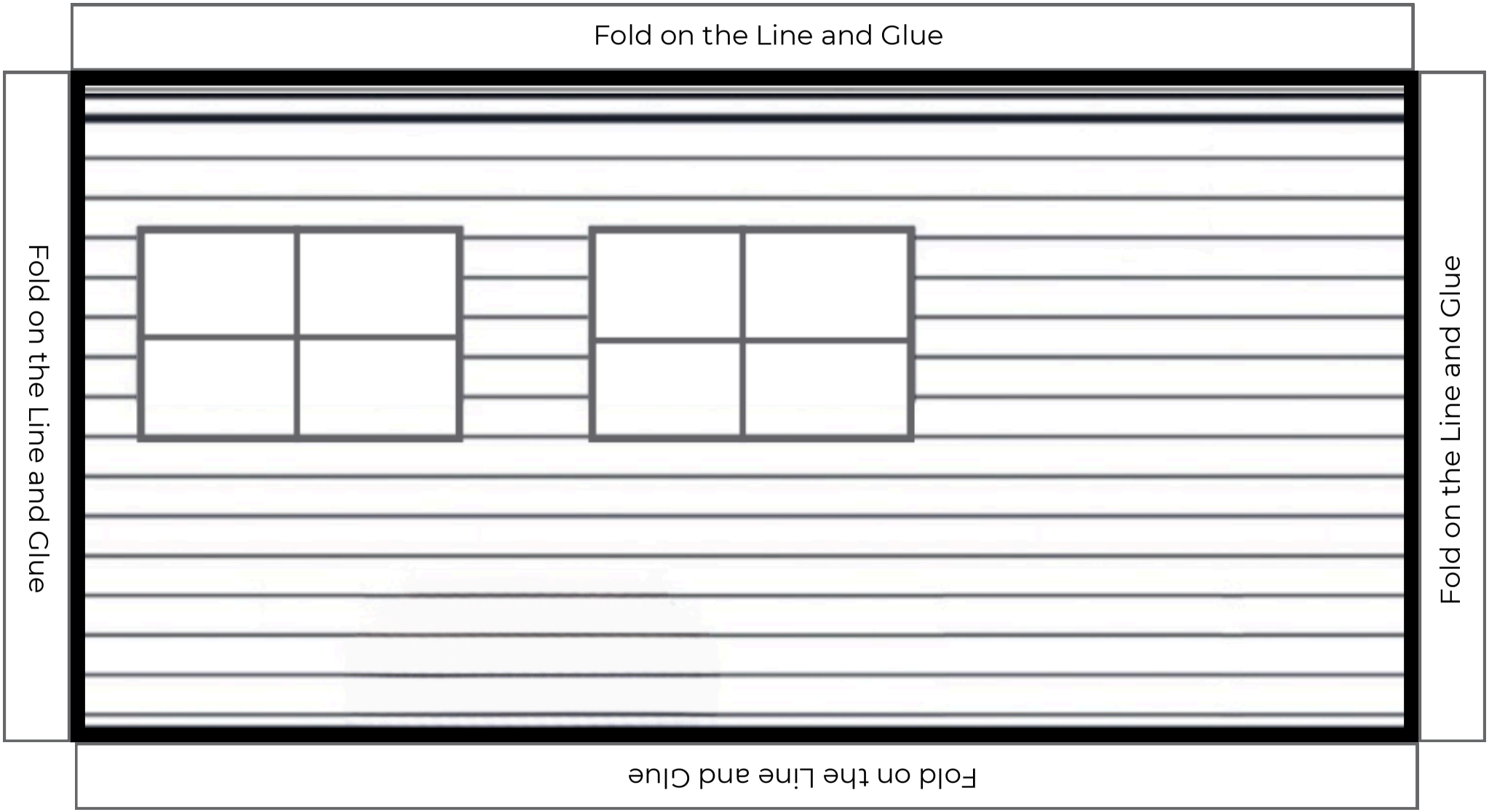
Right Side

Land

Front Side


Fold on the Line and Glue
Fold on the Line and Glue
Fold on the Line and Glue

Back Side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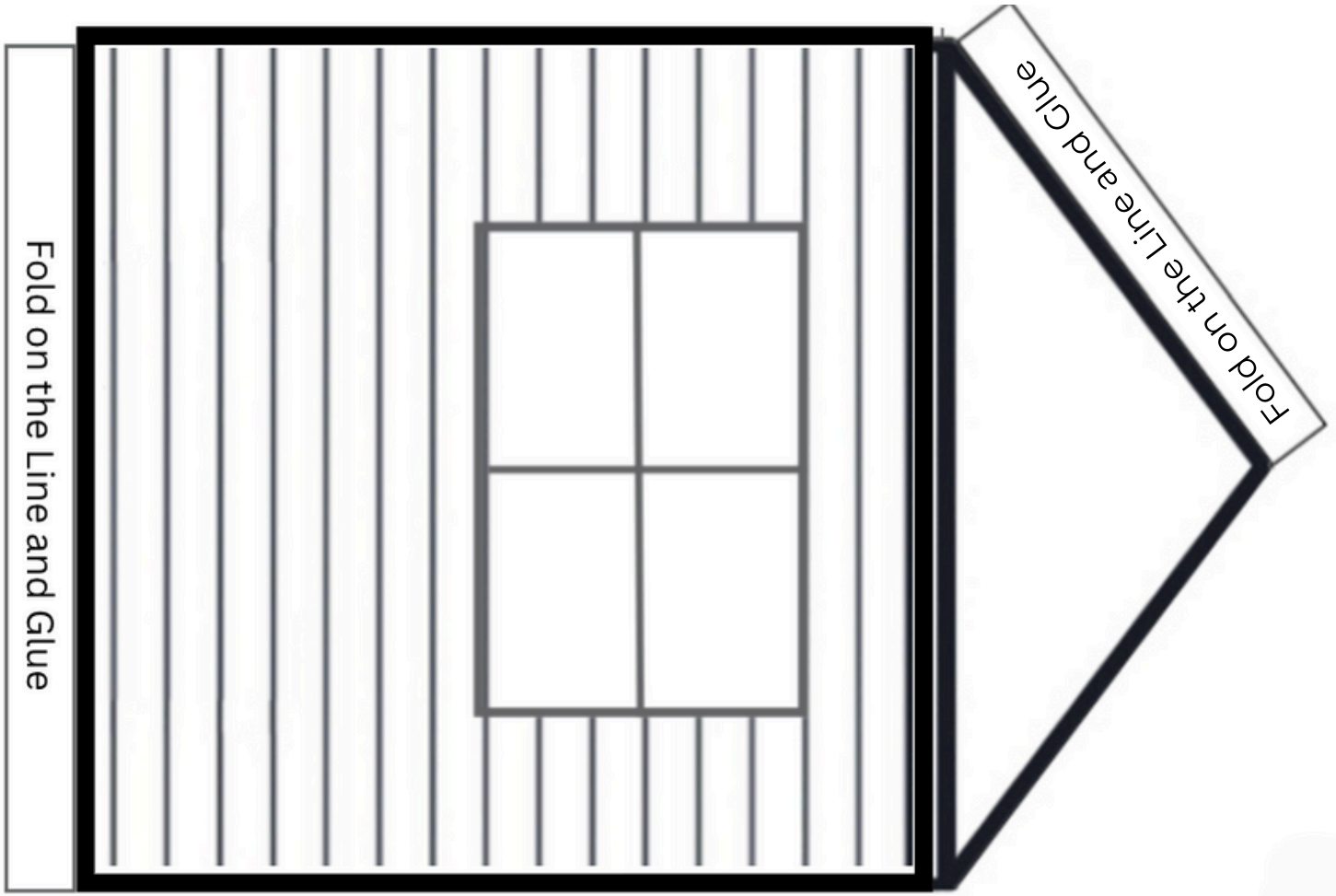
Left-Hand Side



Right-Hand Side

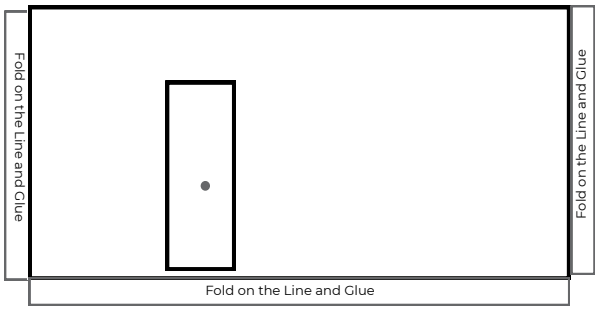
Roof

Fold on the Line and Glue

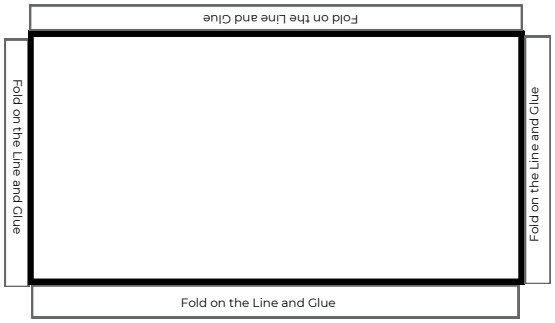
Land

Tiny House Rough Draft Blueprint Templates Without Siding and Windows

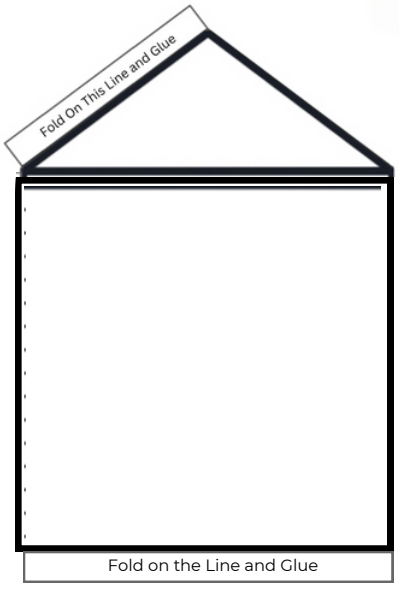
Front Side



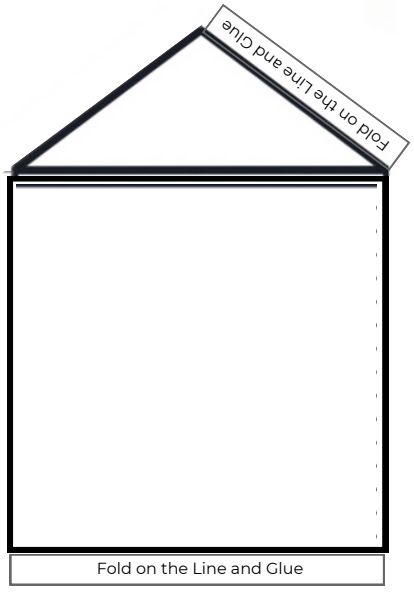
Back Side



Left-Hand Side

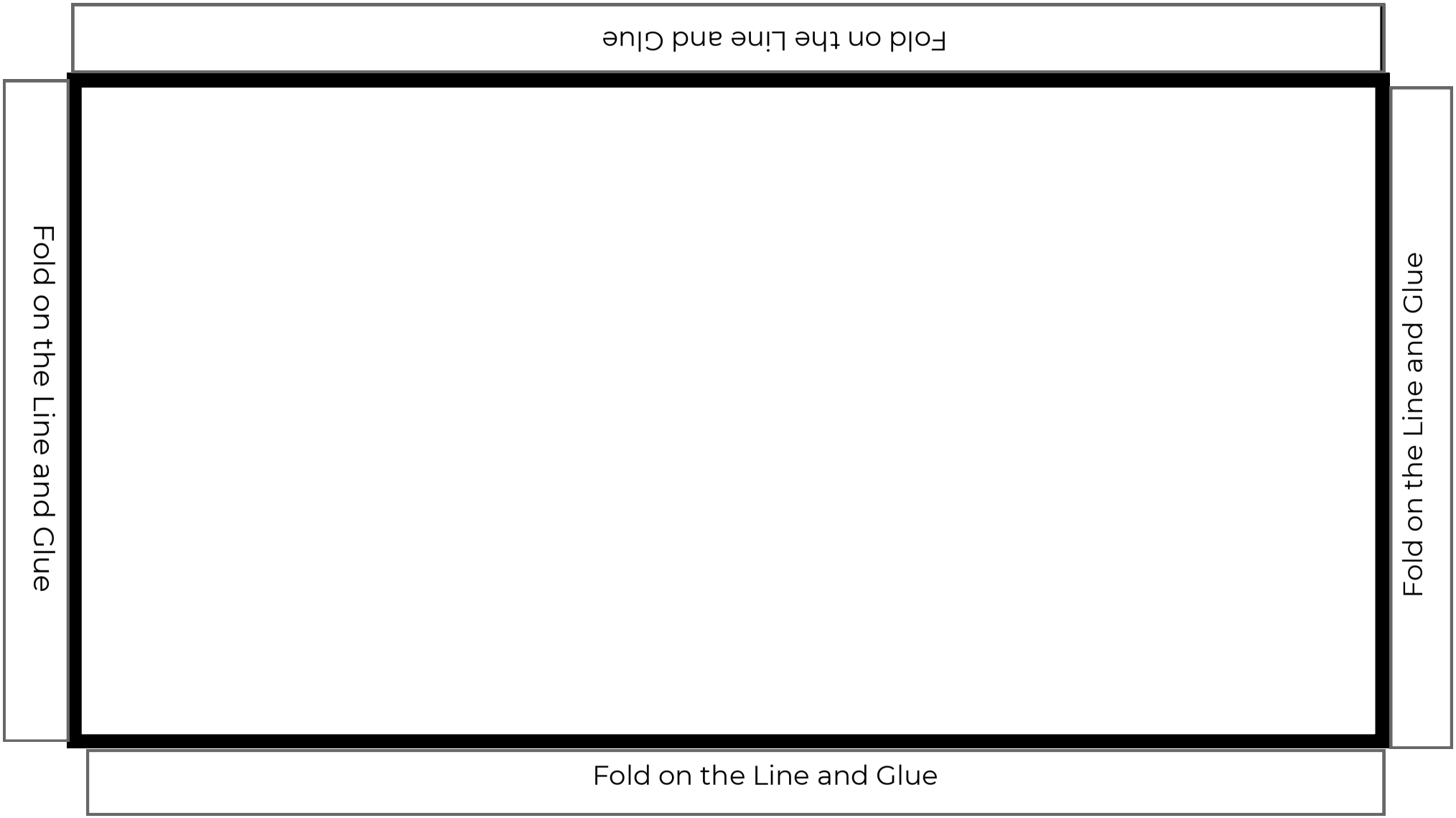


Right-Hand Side



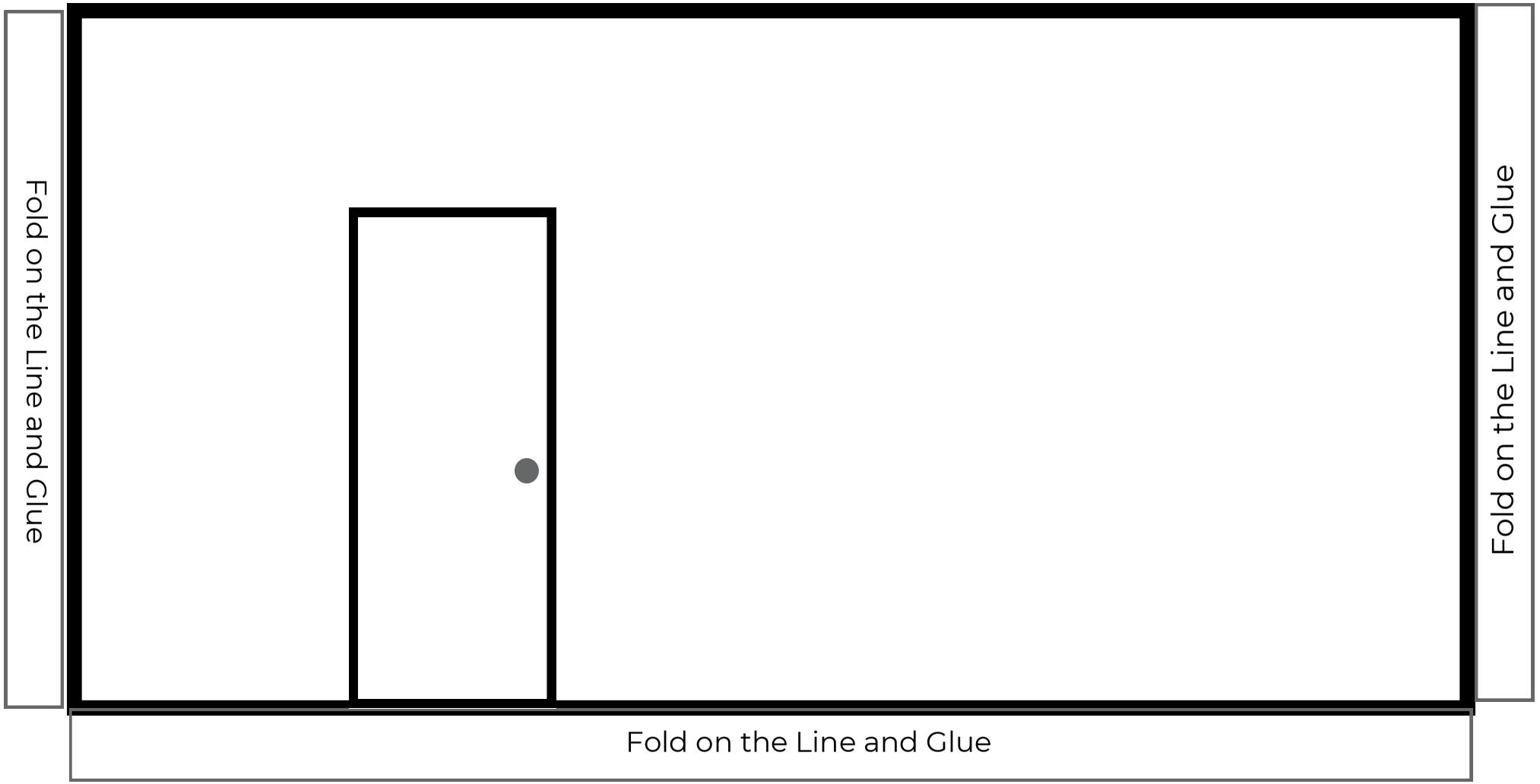
Back Side

(without siding and windows)



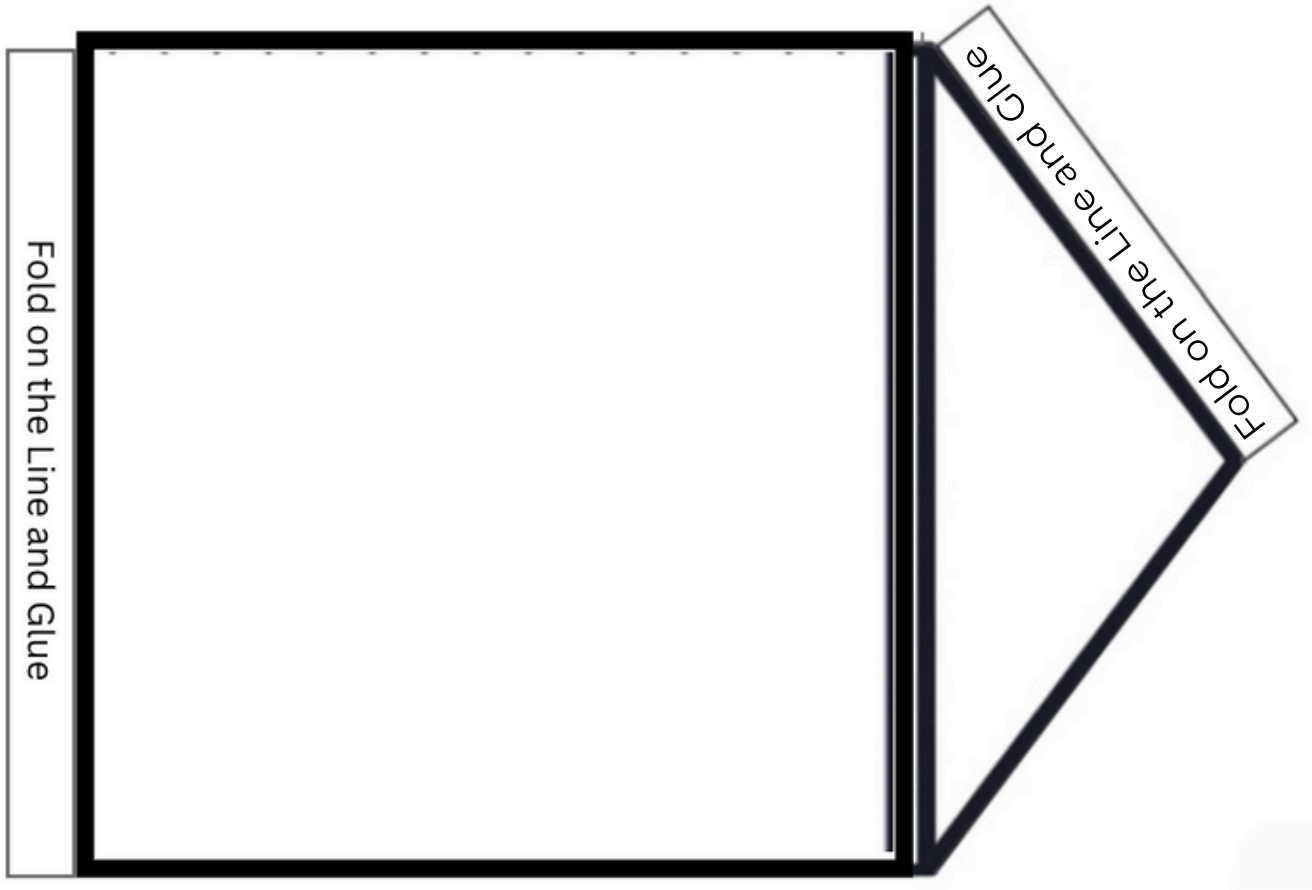
Front Side

(without siding and windows)



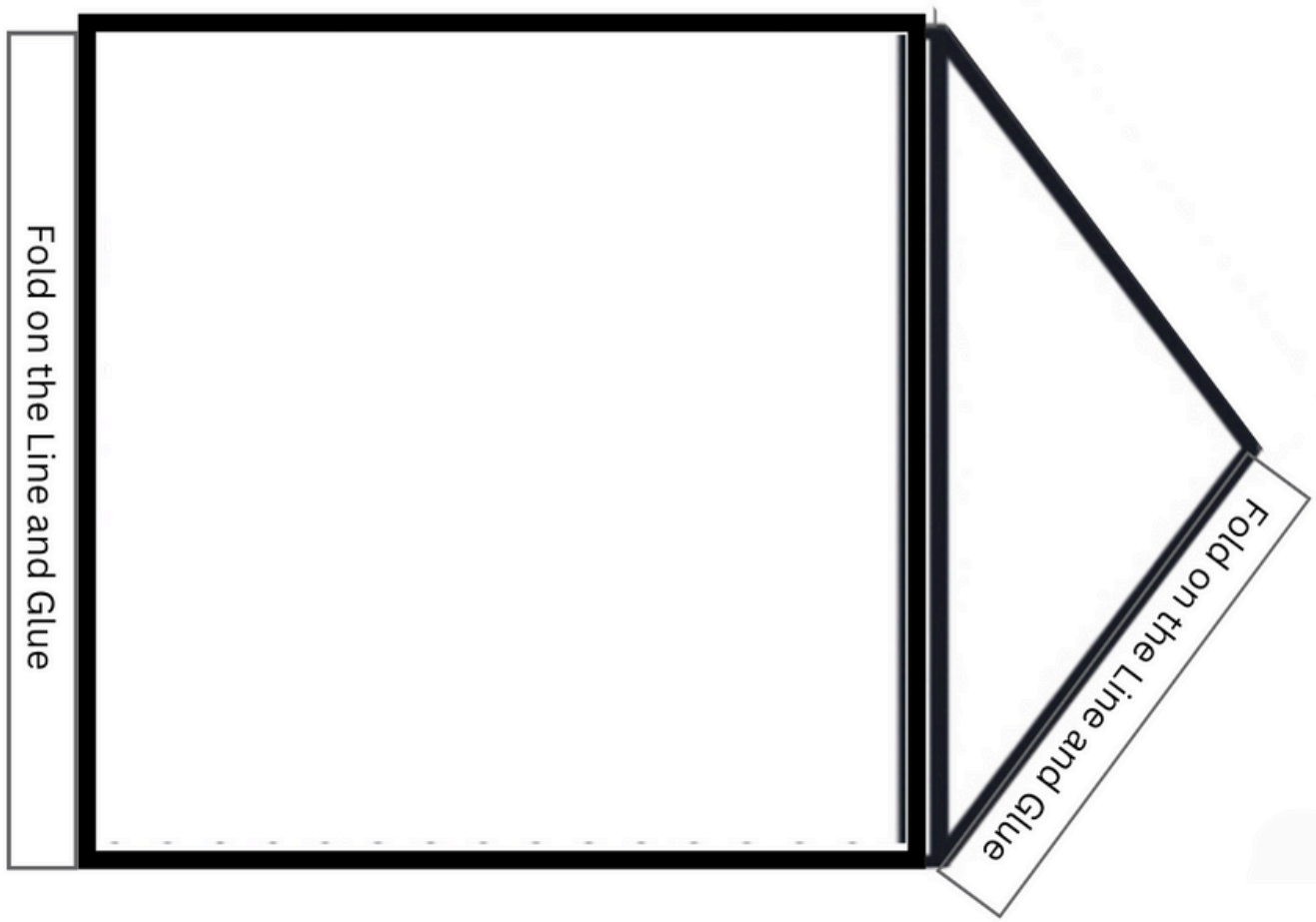
Left-Hand Side

(without siding and a window)



Right-Hand Side

(without siding and a window)



Blank Page For Free-Hand Drawings of Tiny House Components

LESSONS 7-10

ARCHITECTURAL INNOVATIONS: CREATING MODELS USING AUGMENTED REALITY

OVERVIEW

FACILITATOR NOTES

- Lessons 7-10 span four classes for a total of 240 minutes.
- The table below provides an overview of the curriculum structure for Lessons 7-10.

Lesson 7	Lesson 8	Lesson 9	Lesson 10
Lesson Activator Activity: Exploring Augmented Reality	Lesson Activator Activity: Big Ideas Boxes	Lesson Activator Activity: Big Ideas Boxes	Lesson Activator Activity: Big Ideas Boxes
Design Challenge			
Lesson Summarizers			

LESSON ACTIVATORS

- Lesson 7: Exploring Augmented Reality
- Lessons 8-10: Big Ideas Boxes

DESIGN CHALLENGE

Lessons 7-10

Turning A Physical Model into a Virtual Experience Using Augmented Reality Technology

- Background Building: Merge Cube and CoSpaces Video and Tutorial
- Activity: Transforming a Physical Build into a Virtual Experience

The Steps of the Engineering Design Process Addressed in These Lessons:

- Brainstorm Possible Solutions
- Select the Best Possible Solution
- Improve the Design
- Create a Model
- Test and Evaluate

LESSON SUMMARIZERS

- Lesson Summary: discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: encourage students to ask questions about the day's lesson
- Lesson Preview: an overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Describe why idea generation and solution-seeking are essential skills to have as future innovative leaders.
- Identify three *United Nations Sustainable Development Goals* that are the focus of this entire module.
- Identify the **engineering design process** steps needed to turn a physical into a virtual **model**.
- Use a virtual **3D model** to analyze the **effectiveness** of a **design** solution.

VOCABULARY

3D (three dimensional)

architectural blueprint

augmented reality

brainstorm

communicate

constraint

criteria

design

effectiveness

engineering design process

function

impact

innovation

model

technology

test

tools

MATERIALS

Facilitator Use

- 1 projector or SmartBoard
- 1 laptop or desktop
- 1 *Building the Future in 3D* Slide Deck
- 1 *Transforming A Physical Build Into A Virtual Experience Using Augmented Reality Technology Guide*

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 pen
- 1 personalized *Big Ideas Box and Cards*
- 1 *Building the Future in 3D* student notebook
- 1 *Big Ideas Student Discussion Questions* handout

Per Team

Materials are provided for five teams, each with four students.

- 1 tablet and associated charging cord
- 1 tiny house model (constructed during Lessons 4 and 5)
- 1 *Transforming A Physical Build to A Virtual Environment Using Augmented Reality* guide
- 1 Merge Cube

PREPARATION

Before starting Lessons 7-10:

- During this section of the module, if you find teams need additional time to build their virtual tiny house (design challenge section of Lessons 7-10), it is suggested to skip the *Big Ideas Box Lesson Activator* activity.
- Ensure the projector/SmartBoard, and laptop/desktop are connected and working correctly.
- It is essential to watch the two videos (Slides 28 and 29) prior to the start of the lesson. Since the videos are on YouTube, you will need to navigate around the commercials and place the video on “full screen” mode to hide the other advertised videos. Specific viewing timeframes are provided for each video.
    - Video (Slide 28): Pokemon Go Augmented Reality Challenge. Play the entire video (3 min. 4 sec.).
        - Discover Pokémon in the real world with Pokémon go!. Youtube. (2015, September 10). https://www.youtube.com/watch?v=2sj2iQyBTQs

    - Video (Slide 29): How does the Merge Cube work? Play the entire video (1 min. 9 sec.).
        - How does the merge cube work? | #mergecube. YouTube. (2023, August 25). https://youtu.be/aQ-yb4chHWk?feature=shared&t=9

- You will need to create a CoSpaces Pro site license facilitator account with the Merge Cube Add-On. Once your facilitator account is set up, you will need to add one CoSpaces Pro with the Merge Cube Add-On site license for each team to your account.
    - **Facilitator Tip:** Work with your school or district's IT Department to identify the protocols and processes needed to establish student site license accounts.

ASSESSMENTS

- Observations: As students complete various activities, note their individual levels of engagement, their ability to think critically, and their ability to **communicate** effectively. Use their responses and observed peer interactions to informally assess their critical thinking abilities and **communication** skills.

- Questioning: Ask probing questions about the design challenge, **criteria**, and **constraints** to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Written Responses: Examine students' written answers at the end of each lesson. Analyzing written responses can yield valuable insights into students' level of conceptual understanding and will allow you to tailor future instruction accordingly to support students' individual learning needs.

LESSON ACTIVATORS

Lesson 7: Exploring Augmented Reality

1. Ask students if they have any experience with using **augmented reality technology**.
2. Display the slide "Exploring Augmented Reality" (Slide 27) and discuss the definition of **augmented reality** and the difference between augmented and **virtual reality**.
3. Display the slide "Augmented Reality on a Global Scale" (Slide 28). Ask students if they have heard of or played the **augmented reality** game *Pokémon Go*.
4. Play the "Pokémon Go" YouTube video (3 min. 4 sec.) (Slide 28). After the video, briefly discuss the different aspects of **augmented reality** they observed people using and interacting with.
5. Tell the class that now that they have built their tiny house, they are going to turn their physical build into a virtual one using **augmented reality technology**.

6. Display the slide “Augmented Reality Using The Merge Cube” (Slide 29) and show the class the physical version of the Merge Cube.
    - Click on the “How does the Merge Cube work?” hyperlink on the slide to play the video. “How Does the Merge Cube Work? | #mergecube.” YouTube, YouTube, 25 Aug. 2023, https://youtu.be/aQ-yb4chHWk?feature=shared&t=9 .
        - **Facilitator Note:** This video was created for facilitators; however, it does a great job of showing students how the Merge Cube works. Play the following clip from the video 0.00 to 0.33 seconds.
7. Have teams discuss the following:
    - What did we learn about the Merge Cube?
    - How can we use the Merge Cube in our tiny home project?
    - What are you most excited about in using the Merge cude for your design project?

Lessons 8-10: Big Ideas Boxes

1. Welcome students into the class.
2. Display the slide “Big Ideas Box” (Slide 30). As students enter the class, instruct them to follow the directions on the slide.
    - **Facilitator Tip:** If students finish early, tell them to open their notebooks to the page “Big Ideas Peer Discussion Questions” located in the “Appendix.” Direct them to use the questions and prompts on this page to help classmates **brainstorm** ideas and possible solutions.

DESIGN CHALLENGE

Lessons 7-10: Turning A Physical Model Into A Virtual Experience Using Augmented Reality Technology

Lessons 7-8: Background Building: Merge Cube and CoSpaces Tutorials

1. Introduce the goal of transitioning from physical to virtual **design** and explain the importance of digital **modeling** in real-world applications.

2. Demonstration and Software Familiarization:
   - Demonstrate how to use the CoSpaces Edu **3D design** software for creating virtual **models**.
   - Walk the class through basic **tools** and **functions**, such as creating shapes, resizing, rotating, and aligning objects.
   - Hand each design team a *Transforming A Physical Build Into A Virtual Experience Using Augmented Reality Technology* packet.

Lessons 8-10: Background Building: Merge Cube and CoSpaces Tutorials

1. Design and Modeling:
    - Design teams should spend the remainder of the three class sessions, working collaboratively on **designing** their virtual **3D models** based on the **architectural blueprint** physical **model** they created.
    - Encourage design teams to **brainstorm** ideas, incorporate feedback from peers, and problem-solve as they transform their **designs** using **augmented reality technology**.

2. Testing and Refinement:
    - Design teams should **test** their virtual **models** within the software, checking for functionality and **design** accuracy (**criteria** and **constraints**).
    - Teams should make any necessary **refinements** or adjustments based on their **testing** and document those revisions in their notebooks.

LESSON SUMMARIZERS

Lessons 7-10

1. Summarize: ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections
2. Student Questions: encourage students to ask any final questions about the day's lesson
3. Lesson Preview: to build excitement, provide examples of the content and activities students will interact with during the next lesson

EXTENSION ACTIVITIES

- Research and Present: Have students research how they could integrate specific **innovations** or technological advancements that support sustainable development into their **designs**. They can include this information in their final presentation.

- Future Designs and Innovations- Have each student **brainstorm** their own future **innovation** for a tiny home. Encourage them to think beyond current **designs** and technologies. Provide the following **brainstorming** prompts.
  - What new feature or **technology** would you introduce to enhance tiny home living?
  - How could this **innovation** improve sustainability, functionality, or comfort?
  - How your idea could **impact** specific groups, such as families, the elderly, or those with disabilities?

A GLOBAL CHANGEMAKER

The United Nations (U.N.) is a global organization that promotes **cooperation**, **development**, **security**, and **peace** among nations worldwide.

In 2000, the United Nations created **17** *Sustainable Development Goals* to **promote worldwide collaboration**, **action,** and **improvement** by the year 2030.

"Sustainable Development Goals." *United Nations, 2024*, https://www.un.org/sustainabledevelopment/sustainable-development-goals/

The design challenge your team has been tasked with solving supports:

- Goal 1: No Poverty
- Goal 9: Industry, Innovation and Infrastructure
- Goal 11: Sustainable Cities and Communities

LET'S TAKE A CLOSER LOOK

	Poverty can include a lack of: • food • healthcare • shelter • safety • dignity • education
	A focus on: • opportunities for all • promotion of innovative technologies • transportation • communication technology
	Making cities with: • affordable housing • renewable energy • green public spaces • clean water

These three *United Nations Sustainable Development Goals* can guide you toward a better understanding of how issues such as:

basic needs

innovation

empathy

collaboration

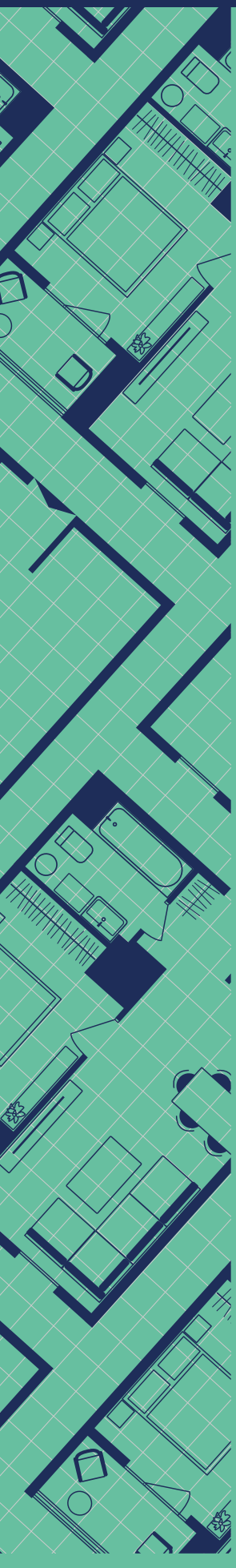
sustainable development

are connected by

innovation

technology

industry



Lesson 11-12

CAREER CONNECTIONS AND ENTREPRENEURIAL EXPERIENCES

OVERVIEW

FACILITATOR NOTES

- Lessons 11-12 span two classes for a total of 120 minutes.
- The table below provides an overview of the curriculum structure for Lessons 11-12.

Lesson 11	Lesson 12
Lesson Activator Background Building: Video Clips	No Lesson Activator
Design Challenge	
Lesson Summarizers	

LESSON ACTIVATORS

- Lesson 11: Video Clips
- Lesson 12: No Lesson Activator

DESIGN CHALLENGE

Lessons 11-12

Career Connections and Entrepreneurial Experiences: Tiny Homes

- Background Building: Career Connections
- Activity: Tiny Home Community Design

The Steps of the Engineering Design Process Addressed in These Lessons:

- Research Ideas and Explore Possibilities
- Brainstorm Possible Solutions
- Create a Model
- Communicate the Results

LESSON SUMMARIZERS

- Lesson Summary: Discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: Encourage students to ask questions about the day's lesson
- Lesson Preview: An overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Discuss entrepreneurial experiences related to the design challenge.
- Collaborate with team members to **plan**, **design**, and create a tiny home community to meet specific specifications.
- Collaborate with team members to prepare a clear and organized presentation of their tiny home community.

VOCABULARY

2D (two-dimensional)

architectural blueprint

brainstorm

communicate

constraint

criteria

design

effectiveness

engineering design process

function

impact

innovation

plan

process

MATERIALS

Facilitator Use

- 1 laptop/computer
- 1 projector/Smartboard
- 1 *Building the Future in 3D* slide deck

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 *Building the Future in 3D* student notebook

Per Team

Materials are provided for five teams, each with four students.

- 1 tablet and associated charging cord
- Colored pencils

PREPARATION

Before starting Lessons 11-12:

- Ensure the projector, SmartBoard, and laptop/desktop are connected and working correctly.

- It is essential to watch all videos on Slide 34 prior to the start of the lesson. Since the videos are on YouTube, you will need to navigate around the commercials and place the video on “full screen” mode to hide advertisements..
  - Video: Tiny Home Build
    - BSTH quick summary. YouTube. (2021, January 5). https://www.youtube.com/watch?v=-N73_YheHpg
  - Video: Big Skills Tiny Homes
    - CHIPS Guest Speakers - Sean Ticknor & Shawn Malone. YouTube. (2024, February 26). https://www.youtube.com/watch?v=ftfStcy7qqk&t=1116s.

- **Facilitator's Notes**:
  - The underlined titles on slide 34 in the slide deck are hyperlinks. Click on the titles to view the videos.
  - When watching video clips opposed to the entire video, it is essential to open the video before the lesson to make sure it is set to begin at the correct timestamp.
  - Focus on fostering a design mindset during these lessons. Encourage students to take as much ownership and decision-making as possible. Do not solve problems for them but guide them to discover their own way of completing the challenge.

ASSESSMENTS

- Questioning: Ask probing questions about the importance and **impact** of careers and entrepreneurial experiences to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Student Presentations: Students will be assessed based on the **innovation** and viability of their tiny home community and their ability to effectively **communicate** their ideas to the class.

LESSON ACTIVATOR

Lesson 11 - Background Building: Video Clips

1. Display the slide “Career Connections and Entrepreneurial Experiences” (Slide 33) as students arrive. Invite students to discuss among themselves any ideas related to the title of the slide displayed.

2. Inform students, *Today, we are going to learn about real-world careers and entrepreneurs related to our tiny home design challenge. First, we are going to watch a short video about a non-profit business that builds tiny homes for those in need in real-life.*

3. Display the slide “An Entrepreneurial Experience” (Slide 34) and play the linked video “Tiny Home Build”. Watch the entire video. (1 minute 24 minutes)

   “*BSTH quick summary” YouTube, Big Skills Tiny Homes, 5 Jan 2021, https://www.youtube.com/watch?v=-N73_YheHpg.”*

4. After watching the video, ask three to five students to share aloud one thing that interested them from the video.

5. Inform students, *Now that we know what this entrepreneurial business does, we are going to watch an interview with the founder Shawn Malone to learn more about his own entrepreneurial experience in starting his non-profit.*

6. Display the slide “An Entrepreneurial Experience” (Slide 34) and click on the title “Big Skills Tiny Homes” to open the video. Watch only the listed video segments totaling 6 minutes 10 seconds.
    - Intro and Career Connections: 18:35 - 20:45 (2 minute 10 seconds)
    - Purpose: 22:55 - 23:30 (35 seconds)
    - Entrepreneurial Experience: 28:40 - 30:25 (2 minutes 45 seconds)
    - Soft Skills: 46:10 - 46:50 (40 seconds)

CHIPS Guest Speakers - Sean Ticknor & Shawn Malone. YouTube. (2024, February 26). https://www.youtube.com/watch?v=ftfStcy7qqk&t=1116s.

7. After watching the video segments, ask three to five students to share aloud one thing they found interesting.

DESIGN CHALLENGE

Lessons 11-12: Career Connections and Entrepreneurial Experiences: Tiny Homes

1. Display the slide “What real-world career connections can you make to the Tiny Home Design Challenge?” (Slide 35).

2. Inform students, *As we learned from the video clips, there is a lot that goes into having a successful entrepreneurial experience. Entrepreneurs need people with a variety of different careers to help bring their plans to life. What required careers were mentioned in the video? What skills have you experienced while designing and building your own tiny home?*
   - *A*cceptable responses: carpentry, plumbing, electrical, framing, furniture building

3. Display the slide “Name That Career!” (Slide 36). Ask students to open their student notebooks to the “Career Connections: Tiny Homes” pages (Pages 28-30).

   Inform students, *Here is a list of some of the careers related*

to building tiny homes. In your notebooks on pages 28-30, you will find the same list; however, your pages contain detailed information about each career including what they do, the required education, and how much they make in a year.

4. Divide the class into their design teams to play a game. Instruct students to bring their notebooks with them.

5. Inform students, *we are going to play a quick game of "Name That Career" to become familiar with the different careers related to building tiny homes. I will read aloud a description of one of the careers listed in your student notebook on pages 28-30. When your team knows the correct career, call out "CAREER" to answer. If your team is correct, you will get a point. If you answer incorrectly, another team will have the opportunity to answer. While teams will be earning, this game is just for fun and gaining new knowledge is the prize.*

- **Facilitator's Note**: Play this game for around five minutes. If time is available at the end of Lesson 12, you can invite the class to play again.

6. Display the slide "Memorandum from the Mayor" (Slide 37). Instruct students to open to the "Memorandum from the Mayor" page in the student notebook (Page 31).

- *Inform students, We have received a Memorandum from the Mayor about trying to solve the Tiny House Design Challenge. A "Memorandum", or memo, is a short, written message used in business, government, and law for messages between employees, reminders, proposals, or records. I am going to read aloud the memo. While I am reading follow along in your notebook.*

7. Read the slide "Memorandum from the Mayor" (Slide 37) aloud to the class.

   Instruct students, *Now that we have read the memo from*

the Mayor, teams need to start to plan your tiny home community the page “Tiny Home Community” in your notebooks by recording the criteria and constraints of this *challenge*.

- Criteria
  - At least 10 tiny homes
  - Infrastructure (including but not limited to): roads, parking, bus stop, etc.
  - Landscaping (including but not limited to): bushes, trees, flowers, etc.
- Constraints
  - Two days to complete

After reviewing the criteria and constraints of the project, instruct students to work in their group to **brainstorm** and complete the Ideas section on the page “Tiny Home Community Plan” in their notebooks (Page 32).

8. Display the slide “Your Design Team Will Create” (Slide 38) and ask students to turn to the page “Tiny Home Community Design” in their student notebooks (Page 33).

   Instruct students, *Teams are now going to **design** your tiny home community in a similar way to how you designed your tiny homes. Remember to look at your “Tiny Home Community Plan” to make sure you include all the requirements.*

9. As teams complete their designs, instruct them to complete the page “Tiny Home Community Description” on Page 34.

   Tell students they will name their community and write at least three to five descriptive sentences about their tiny home community.

- **Facilitator's Note**: This aspect of the challenge is meant to be open-ended and give the students the opportunity to use creativity and **innovation** with little/no assistance or ideas from adults. You can facilitate this mindset by responding to questions with thought-provoking questions.

10. If time permits, teams should present their tiny home community concepts to the class.

LESSON SUMMARIZERS

Lessons 11-12

1. Summarize: Ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections.

2. Student Questions: Encourage students to ask any final questions about the day's lesson.

3. Lesson Preview: To build excitement, provide examples of the content and activities students will interact with during the next lesson.

Career Connections
Tiny Homes

CAREER	DESCRIPTION	EDUCATION	SALARY
Structural Designer	Creates **blueprints** for large structures, such as building and bridges, to ensure safety and stability.	Master's Degree & Professional Licensing	$76,000 – $116,000 per year
Construction Manager	Oversees the planning, budgeting, coordination, and supervision of construction projects	Bachelor's Degree	$92,000 - $134,000 per year
Building Contractor	Organize the construction of houses and offices, including supplying workers and materials	Skilled Training & Experience	$60,000 - $108,000 per year
Interior Designer	Plan, design, and furnish interiors of residential, commercial, or industrial buildings	Bachelor's Degree & Skilled Training	$60,000 - $180,000 per year
Real Estate Agent	Helps people buy, sell, or rent properties	High School Diploma & Specialized Licensing	$36,000 - $302,000 per year
Urban Planner	**Directs the development of cities and towns including** buildings, parks, and roads.	Master's Degree	$60,000 - $127,000 per year

Career Connections
Tiny Homes

CAREER	DESCRIPTION	EDUCATION	SALARY
Architect	Designs buildings and structures, and ensures they are safe and functional	Bachelor's Degree	$89,000 - $270,000 per year
Civil Engineer	Plans, designs, and maintains public and private infrastructure projects: roads, bridges, tunnels, building, airports, railroads, etc..	Bachelor's Degree	$85,000 - $168,000 per year
Community Service Manager	Coordinate and supervise programs and organizations that support public well-being.	Bachelor's Degree	$49,000 - $76,000 per year
Building Inspector	Ensures that construction projects meet local and national building codes and safety standards.	Associate's or Bachelor's Degree	$53,000 - $138,000 per year
Manufacturer	Takes raw materials and turns them into products to sell.	Associate's or Bachelor's Degree	$70,000 - $222,000 per year

Career Connections
Tiny Homes

CAREER	DESCRIPTION	EDUCATION	SALARY
Electrician	Installs, maintains, and repairs electrical systems.	High School Diploma & Specialized Licensing	$49,000 - $97,000 per year
Plumber	Installs, maintains, and repairs pipes and fixtures that supply water and remove waste from buildings.	Vocational Training & Certification	$54,000 - $102,000 per year
Surveyor	Measures and maps land and buildings to help people understand their size and shape.	Bachelor's Degree	$56,000 - $112,000 per year
Carpenter	Builds and repairs wooden structures and other building materials.	Vocational Training & Certification	$54,000 - $110,000 per year
Welder	Uses heat to join materials together, such as metals, plastics, or polymers.	Vocational Training & Certification	$42,000 - $138,000 per year
Roofer	Installs, repairs, or replaces roofs on buildings.	High School Diploma	$43,000 - $95,000 per year

MEMORANDUM

TO: Students of Our Great Community
FROM: Mayor
SUBJECT: Temporary Housing Solution

After the success of the temporary housing solutions for our homeless population, the Community Commission has proposed the establishment of a permanent tiny home community for a permanent solution for our homeless population. Make note of what career professionals will need to be hired for this project.

CRITERIA

I. COMMUNITY SPECIFICATIONS

1. At least 10 tiny homes
2. Infrastructure (including but not limited to: roads, parking lots, bus stop, driveways. etc.)
3. Landscaping (including but not limited to: bushes, trees, flowers, etc.)

II. COMMUNITY APPLICATION

1. A tiny home community plan
2. A tiny home community design
3. A description of the tiny home community

CONSTRAINTS

- Two days will be given to plan and design a tiny home community.

If you have any questions, please contact your on-site facilitator for more information.

Tiny Home Community Plan

Criteria	Constraints

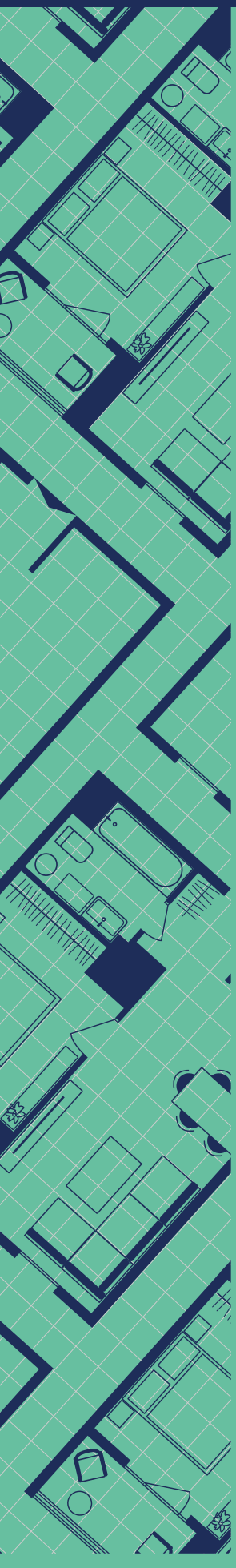
Ideas
•
•
•
•
•
•

Tiny Home Community Design

Tiny Home Community Description

Name of Tiny Home Community

Description



Lesson 13

SHELTER INNOVATORS: PREPARING TO PRESENT

LESSON OVERVIEW

LESSON ACTIVATORS

- Activity: Big Ideas Boxes

DESIGN CHALLENGE

- Background Building: Conducting A Successful Team Presentation
- Activity: Team Presentation Planning

Engineering Design Process Steps Addressed in This Lesson:

- Communicating the Results

LESSON SUMMARIZERS

- Lesson Summary: discussion of the lesson's key points and connections to real-world applications and careers
- Student Questions: encourage students to ask questions about the day's lesson
- Lesson Preview: an overview of the content and activities students will experience in the upcoming lesson

OBJECTIVES

Students will be able to:

- Collaborate with team members to prepare a clear and organized presentation about their solution to the real-world challenge.
- Provide feedback to peers on their presentations, fostering collaboration and critical thinking skills.
- Analyze how their tiny home **design** addresses the specific **criteria** and **constraints**, demonstrating a clear understanding of how their solutions meet the identified needs.

VOCABULARY

architectural blueprint

augmented reality

communicate

constraint

criteria

design

effectiveness

impact

innovation

model

plan

process

refine

reflect

technology

MATERIALS

Facilitator Use

- 1 laptop/computer
- 1 projector/Smartboard
- 1 *Building the Future in 3D* slide deck

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 personalized *Big Ideas Box* and *Big Ideas Cards*
- 1 *Building the Future in 3D* student notebook

Per Team

Materials are provided for five teams, each with four students.

- 1 tablet and associated charging cord
- 1 Merge Cube
- 1 tiny house physical model (built during lessons 4-5)

PREPARATION

Before the start of this lesson:

- Ensure the projector, SmartBoard, and laptop/desktop are connected and working correctly.
- Display the slide “Shelter Innovators: Preparing to Present” (Slide 41).
- If one class period will not be enough time for teams to **plan** their presentations, the *Lesson Activator* and *Lesson Summarizers* activities can be removed from this lesson.

ASSESSMENTS

- Questioning: Ask probing questions about the design challenge, **criteria**, and **constraints** to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Student Presentations: Students will be assessed based on their teamwork, the completeness of their presentation, the creativity and accuracy of their house **designs**, and their ability to effectively **communicate** their ideas to the class.

LESSON ACTIVATOR

Activity: Big Ideas Boxes

1. Welcome students into the class.

2. Display the slide “Big Ideas Box” (Slide 40). As students enter the class, instruct them to follow the directions on the slide.

    - **Facilitator Tip:** If students finish early, tell them to open their notebooks to the page “Big Ideas Peer Discussion Questions” located in the “Appendix.” Direct them to use the questions and prompts on this page to help classmates **brainstorm** ideas and possible solutions.

DESIGN CHALLENGE

Background Building: Conducting a Successful Team Presentation

1. Display the slide “Teamwork As An Essential Skill” (Slide 41). Start the class by posing the following question, *How can you effectively collaborate as a team to create an informative presentation?*

2. Share that in the real world, professionals often need to work together to prepare and deliver presentations on various topics, making teamwork an essential skill.

3. Tell the class. “Today, you will get to showcase your tiny home **designs** and give and receive feedback from your peers before our final presentations next week. Before we dive into our tiny home design presentations, let’s take some time to think about what makes a presentation successful.”

4. Display the slide “Key Elements of Presentations” (Slide 42). Inform the class that, “Today, we’re going to create a list of key elements that are important in any presentation. ”Using the following prompts, hold a brief discussion about successful presentations:
    - *How can you make sure your audience understands what you are saying?*
    - *How can you show confidence even when nervous?*
    - *What are the parts of a presentation?*

5. Tell teams that today, they will be **planning** and organizing their presentations that will be presented during the last two classes of this module. Teams will use the “Team Presentation Planning” pages in their notebooks.

6. Display the slide “Presentation Planning” (Slide 43). Go through the “Team Presentation Planning” pages located in their notebooks and explain each section. Stress the importance of each member knowing what they are responsible for during the presentation.

Activity: Team Presentation Planning

1. Give teams the remainder of the class time to **plan** their presentation.

2. If enough time permits, have teams partner with another team to practice their presentations.

   Discuss what *constructive feedback* is and is not and why it is important for teams to receive this type of feedback before making their final presentations.

3. While one team is presenting, the other team should document their feedback on the Team Presentation Feedback document (three pages) located in their notebooks.

LESSON SUMMARIZERS

1. Summarize: ask students to turn to a partner to discuss the key takeaways from the day's lesson, real-world applications, and career connections

2. Student Questions: encourage students to ask any final questions about the day's lesson

3. Lesson Preview: to build excitement, provide examples of the content and activities students will interact with during the next lesson

Team Presentation Planning

Use the questions below to guide you in planning your presentation. Place your initial or name next to each part you will present.

1. **Introduction:** Who is on your team? (All team members should introduce themselves.)

2. **Problem Statement:** What problem were you tasked to solve? (Include the **criteria** and **constraints.**)

3. **Design Solution:** Which **model** (**2D**, **3D**, **Augmented Reality (AR)**) best displays your team's solution to the real-world problem? Explain your thinking.

4. **Impact:** How does your tiny home help solve the problem?

5. **Reflection and Conclusion:** If your team had a chance to revise your **design**, what improvements would you make? Explain your thinking**.**

Tips for a Successful Presentation:

- Be Clear: Make sure each part of your presentation is easy to understand.
- Use Visuals: Show pictures and models to help explain your ideas.
- Engage: Look at the audience and interact with them.
- Be Confident: Speak with confidence and show that you know your **design** solution well.

Team Presentation Feedback

You will use this form to provide feedback on the presentations.

Your Name: _____

Team Presenting: _____

Introduction

Did the team introduce all their members and their roles?

- Yes / No

Was the introduction clear and interesting?

- Yes / No

Comments:

_____

_____

Problem Statement and Objectives

Did the team explain the problem they are trying to solve?

- Yes / No

Was the problem clearly stated?

- Yes / No

Did the team talk about the **criteria** their **design** solution needed to have?

- Yes / No

Did they explain the **constraints** their **design** solution need to follow?

- Yes / No

Comments:

_____

_____

Design Solution

Did the team explain the **design** features of their tiny house?

- Yes / No

Did they show their **2D** floor plan?

- Yes / No

Did they show their **3D** model?

- Yes / No

Did they show their **Augmented Reality (AR)** simulation?

- Yes / No

Comments:

_____

_____

Impact Assessment

Did the team explain how their **design** solves the problem?

- Yes / No

Comments:

_____

_____

Reflection and Conclusion

Did the team share what they learned from the project?

- Yes / No

Did they discuss how they could improve their **design** in the future?

- Yes / No

Comments:

_____

_____

Overall Presentation

Was the presentation easy to understand?

- Yes / No

Was the presentation engaging and interesting?

- Yes / No

Did the team answer questions well?

- Yes / No

Comments:

_____

_____

Final Thoughts

What did you like most about the presentation?

_____

_____

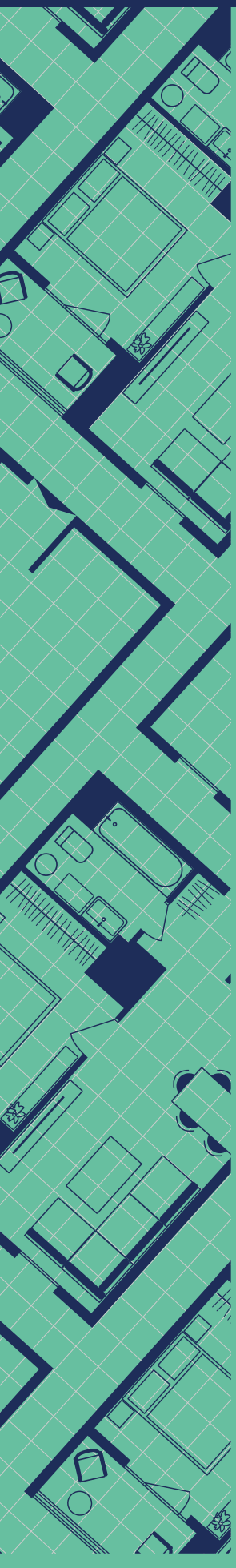
_____

What is one suggestion you have for the team?

_____

_____

_____



Lessons 14-15

Shelter Innovators: Presenting Solutions for Displaced Individuals

Engineering Design Process Steps Addressed in This Lesson:

- Communicating the Results

LESSON SUMMARIZERS

- Lesson 14
  - Lesson Summary: discussion of the lesson's key points and connections to real-world applications and careers
  - Student Questions: encourage students to ask questions about the day's lesson
  - Lesson Preview: an overview of the content and activities students will experience in the upcoming lesson

- Lesson 15 Module Wrap-Up
  - Activity (optional): Written Reflection
  - Activity: Discussion of the module's key points, real-world applications, and career connections.

LESSON OVERVIEW

FACILITATOR NOTES

- Lessons 14-15 span two classes for a total of 120 minutes.
- The table below provides an overview of the curriculum structure for Lessons 14-15.

Lesson 14	Lesson 15
Lesson Activator Activity: Big Ideas Boxes	Lesson Activator Activity: Big Ideas Boxes
Design Challenge	
Lesson Summarizers	

LESSON ACTIVATOR

- Activity (Lessons 14 and 15): Big Ideas Boxes

DESIGN CHALLENGE

- Activity (Lessons 14 and 15): Team Presentations
- Activity (Lesson 15): Show What You Know Questionnaire

Lesson 14-15: Shelter Innovators - Presenting Solutions

OBJECTIVES

Students will be able to:

- Present their solution as a design team using student notebooks, **architectural blueprints**, physical builds, and **augmented reality** displays.
- Identify how their team addressed the **criteria** and **constraints** in their **design** solution.
- Respond clearly to questions and feedback from peers about their **design** choices, problem-solving strategies, and the **impact** of their tiny house solution.
- **Reflect** on their learning and the overall **design process**, identifying lessons learned and areas for improvement.

VOCABULARY

2D (two-dimensional)

3D (three dimensional)

architectural blueprint

augmented reality

communicate

constraint

criteria

design

engineering design process

impact

innovation

model

process

reflect

MATERIALS

Facilitator Use

- laptop or desktop
- projector or SmartBoard
- *Building the Future in 3D* slide deck
- *1 Show What You Know Questionnaire Answer Key* (located at the end of this lesson)

Per Student

Materials are provided for a class of 20 students.

- 1 pencil
- 1 personalized *Big Ideas Box* and *Big Ideas Cards*
- 1 *Building the Future in 3D* student notebook
- 1 *Show What You Know Questionnaire* (A class set is included in the curriculum kit.)

Per Team

Materials are provided for five teams, each with four students.

- 1 tablet and associated charging cord
- 1 Merge Cube
- 1 tiny house model (built during lessons 3-6)

PREPARATION

Before the start of this lesson:

- Ensure the projector, SmartBoard, and laptop/desktop are connected and working correctly.
- Display the slide “Shelter Innovators - Presenting Solutions for Displaced individuals” (Slide 46).

ASSESSMENTS

- Questioning: Ask probing questions about the design challenge, **criteria**, and **constraints** to engage students in individual and team discussions. Encourage students to explain their thinking, elaborate on their ideas, and consider alternative perspectives. Use those responses to informally assess their level of conceptual understanding and critical thinking abilities.

- Student Presentations: Students will be assessed based on their teamwork, the completeness of their presentation, the creativity and accuracy of their house **designs**, and their ability to effectively **communicate** their ideas to the class.

LESSON ACTIVATOR

Activity (Lessons 14 and 15): Big Ideas Boxes

1. Welcome students into the class.

2. Display the slide “Big Ideas Box” (Slide 46). As students enter the class, instruct them to follow the directions on the slide.
    - **Facilitator Tip:** If students finish early, tell them to open their notebooks to the page “Big Ideas Peer Discussion Questions” located in the “Appendix.” Direct them to use the questions and prompts on this page to help classmates **brainstorm** ideas and possible solutions.

DESIGN CHALLENGE

Activity (Lessons 14 and 15): Team Presentations

1. Display the slide “Shelter Innovators: Presenting Solutions for Displaced Individuals” (Slide 44). Remind teams that today is their chance to showcase their physical and digital tiny house builds and explain how their **design** provides a solution to the real-world challenge given to them by the Mayor.

2. Review the structure that will be used with the presentations. Remind teams they will each have ten minutes to present.

3. Once all teams have presented, congratulate students for the hard work they put into their **designs** and presentations.

LESSON SUMMARIZERS

Activity (Lesson 15): Show What You Know Questionnaire

1. Display the slide “Show What You Know Questionnaire” (Slide 47).

   Inform students that they will complete a “Post-Show What You Know Questionnaire.” Tell them this is the same questionnaire they took during the three-week Setting the Stage for **Innovation** units (aka modules). Although this is not a graded assignment, this post-questionnaire will show you, as the facilitator, the knowledge each student has gained during the *Setting the Stage for **Innovation*** and *Building the Future in **3D*** units.

2. If extra time permits, review each question and answer with the class.

Optional Activity: *Building the Future in 3D* Reflection

Facilitator Note: If extra time permits, students can complete this **reflection** activity.

1 Ask students to open to the "*Building the Future in **3D Reflection***" page in their notebooks.

Tell students that this is their personal time to **reflect** on what they have learned in this module.

Give the students time to complete the "*Building the Future in **3D Reflection***" page.

2. Once all students have had a chance to complete the activity, ask students to share some of their responses with the class.

3. Module Wrap-up: Hold a brief class discussion that allows students to:
   - Summarize their experience with **augmented reality**
   - Make connections between AR and associated college

and career pathways

- Make connections between their experience completing the design challenge and entrepreneurial skills

Name: _____ Date: _____

Show What You Know Questionnaire

1. **Which of the following is an example of an innovative solution to a problem?**

   A) Using traditional farming methods to increase crop yield.
   B) Developing biodegradable packaging to reduce waste.
   C) Ignoring environmental concerns to maximize profit.
   D) Following the same process without changes.

2. **How does technology impact society?**

   A) It has no effect on social interactions.
   B) It can change how people communicate and work.
   C) It only affects large businesses.
   D) It decreases productivity.

3. **How does the engineering design process help solve real-world problems?**

   A) By providing steps to solve problems quickly.
   B) By encouraging creativity and innovation within guidelines.
   C) By avoiding testing and experimenting with ideas.
   D) By focusing on innovative ideas without practical use.

4. **What is augmented reality (AR)?**

   A) Overlays digital information onto the real world.
   B) Replaces the real world with a virtual environment.
   C) Enhances communication through holograms.
   D) Creates realistic graphics for video games.

5. **Short Answer: Describe a way you think technology might positively change the future.**

Show What You Know Questionnaire Answer Key

1. **Which of the following is an example of an innovative solution to a problem?**

   A) Using traditional farming methods to increase crop yield.
   B) Developing biodegradable packaging to reduce waste.
   C) Ignoring environmental concerns to maximize profit.
   D) Following the same process without changes.

2. **How does technology impact society?**

   A) It has no effect on social interactions.
   B) It can change how people communicate and work.
   C) It only affects large businesses.
   D) It decreases productivity.

3. **How does the engineering design process help solve real-world problems?**

   A) By providing steps to solve problems quickly.
   B) By encouraging creativity and innovation within guidelines.
   C) By avoiding testing and experimenting with ideas.
   D) By focusing on innovative ideas without practical use.

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   A) Overlays digital information onto the real world.
   B) Replaces the real world with a virtual environment.
   C) Enhances communication through holograms.
   D) Creates realistic graphics for video games.

5. **Short Answer: Describe a way you think technology might change in the future.**

Answers May Vary

Sample Answer: I think technology might change the future by having more robots that help us. They could do chores like cleaning the house or even help with homework. This would make our lives easier and give us more time to participate in after-school clubs, spend time with family, and do activities and hobbies that we enjoy.

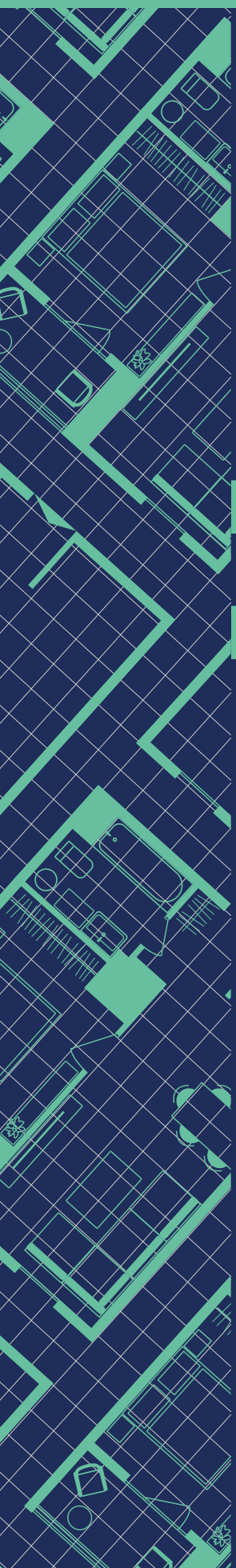
Building the Future in 3D Reflection

1. What did you learn from this real-world design challenge?

2. What were the biggest challenges you faced, and how did you overcome them?

3. What changes would you make if you did this project again?

4. How was clear communication important in this **process**?



APPENDIX

- VOCABULARY TERMS
- TEAM AND TECHNOLOGY ASSIGNMENTS DOCUMENT

2D (TWO-DIMENSIONAL)	a flat figure or a shape that has two dimensions (length and width). Two-dimensional (2D) shapes do not have any thickness.
3D (THREE-DIMENSIONAL)	a solid figure, object, or shape that has three dimensions (length, width, and height). Three-dimensional (3D) shapes have thickness.
ARCHITECTURAL BLUEPRINT	detailed drawing that shows how a building will be built, including its layout, dimensions and materials.
AUGMENTED REALITY (AR)	technology that layers virtual objects into real life, usually with a tablet or smartphone, allow people to interact with digital elements in their physical surroundings
BRAINSTORM	to suggest and discuss ideas for solving a problem
COMMUNICATE	to share information orally, in written form and/or graphically through various forms of media
CONSTRAINT	a limit or condition on the features or functions of a design
CRITERIA	a list of items (specifications) that must be met in order for a solution to be considered successful

DESIGN	the process for creating structures or systems to meet specific needs
DIAGRAM	a visual representation of data or information
EFFECTIVENESS	a determination of how well a solution meets the criteria
ENGINEER	a person who designs structures and systems that address specific needs
ENGINEERING DESIGN PROCESS	a series of flexible problem solving steps that move a model from problem to solution
FAILURE	the inability of a device, process, or system to perform a required function
FUNCTION	a specific task that a system or part of a system performs or is intended to perform
IMPACT	the effects of an engineering design
INNOVATION	process of creating new ideas, processes, services, or products that solve problems in new or improved ways
INNOVATIVE TECHNOLOGY	new or improved tool, system or process that introduces significant improvements or solve problems in new and clever ways

MODEL	a diagram, replica, mathematical representation, or computer simulation used to analyze a system for flaws, test a solution, visualize or refine a design, and/or communicate design features
MODIFY	changes made to a design/build
PLAN	a systematic approach to solving a problem
PROCESS	a series of steps that form a pathway to a solution
REFINE	to improve through small changes
REFLECT	to analyze a course of action, process, or experience in order to generate a future improvement or modification
SCALE	the relationship between the size of an accurate representation of an object and the actual object itself
SPECIFICATIONS	a detailed written record specific to the criteria needed to solve the problem; the technical information about “what” is needed
TECHNOLOGY	any tool system of process created by humans to solve problems or make tasks/life easier
TOOL	anything that helps people shape, build, or produce things to meet their needs

TEST	to determine whether or not a design, model, process, or system meets the criteria as a possible solution
VIRTUAL REALITY (VR)	technology that replaces the real world with a simulated world that you can explore and interact with.

Team and Technology Assignments

Team	Team Members	Team Name	Assigned Technology
1	1._____ 2._____ 3._____ 4._____		
2	1._____ 2._____ 3._____ 4._____		
3	1._____ 2._____ 3._____ 4._____		
4	1._____ 2._____ 3._____ 4._____		
5	1._____ 2._____ 3._____ 4._____		

Big Ideas
Peer Discussion Questions

Use these discussion questions when working with your peers to explore and expand on ideas and solutions designed to support a positive change in your community and beyond!

Idea Generating

- Are there any specific areas, such as education, health, environment, or safety, where improvements are needed?
- What challenges or issues do you see at our school or in your neighborhood?
- What inspired your idea for addressing this problem?
- Are there environmental concerns or sustainability issues that need to be addressed?
- What improvements could enhance the quality of life for residents in your community (e.g., transportation, utilities, public spaces)?

Solution Seeking

- How can **technology** and **innovation** be used to help you create a solution to the problem?
- How do you envision your solution making a positive **impact** on the community?
- Are there any existing solutions or initiatives that you find inspiring and could serve as **models** for your own ideas?
- Is there another way to solve this issue?

Evaluating Solutions

- What are the potential challenges you might encounter when implementing your solution?
- How would you measure the success or **effectiveness** of your solution?

Lesson 1: The Endless Possibilities of Big Ideas

VOCABULARY

3D (three dimensional)

augmented reality

blueprint

brainstorm

communicate

constraint

criteria

design

diagram

engineer

engineering design process

innovation

innovative technology

model

technology

VOCABULARY

brainstorm

communicate

constraint

criteria

design

diagram

effectiveness

engineering design process

impact

innovation

model

process

technology

Lessons 3-6: Thinking Big With Small Spaces

VOCABULARY

2D (two-dimensional)

3D (three dimensional)

architectural blueprint

augmented reality

brainstorm

communicate

constraint

criteria

design

effectiveness

engineer

engineering design process

function

impact

innovation

model

plan

process

refine

reflect

technology

test

tool

Lessons 7-10: Architectural Innovations

VOCABULARY

3D (three dimensional)

architectural blueprint

augmented reality

brainstorm

communicate

constraint

criteria

design

effectiveness

engineering design process

function

impact

innovation

model

technology

test

tools

Lesson 11-12: Career Connections & Entrepreneurial Experiences

VOCABULARY

2D (two-dimensional)

architectural blueprint

brainstorm

communicate

constraint

criteria

design

effectiveness

engineering design process

function

impact

innovation

plan

process

Lesson 13: Shelter Innovators - Preparing to Present

VOCABULARY

architectural blueprint

augmented reality

communicate

constraint

criteria

design

effectiveness

impact

innovation

model

plan

process

refine

reflect

technology

Lesson 14-15: Shelter Innovators - Presenting Solutions

VOCABULARY

2D (two-dimensional)

3D (three dimensional)

architectural blueprint

augmented reality

communicate

constraint

criteria

design

engineering design process

impact

innovation

model

process

reflect