***WABS STEM PBL Unit/Lesson Plan Template***

**Description:**

Problem-based learning (PBL) is focused, experimental learning organized around the investigation and resolution of messy and real world problems. Teachers function as coaches to guide student inquiry and facilitate learning to build deeper levels of understanding for students.

Research indicates that PBL is a superior pedagogy for promoting student engagement in the learning process. Torp and Sage (2002)1 broaden the impact of this pedagogy and confirm that it increases motivation, makes learning relevant to the real world, and promotes higher order thinking and self-regulated learning in students.

Generally, the teacher will present the problematic situation. The problem is ill-structured and messy (multiple sub-problems), is not easily solved, and **does not result in one right answer**. Students engage in active problem solving, and teachers guide and coach. A collaborative environment provides for the sharing of information within and between groups as they work to resolve - some may test and re-resolve - the problem. Authentic assessment complements the problem solving process.

**WABS PBL Requirements**

1. With your team, develop a PBL unit and PBL unit overview.
2. Teach the PBL in your classroom.
3. Gather artifacts from the lesson (such as student work, student interviews, photographs, or other ways to track student engagement and learning about content & practices, soft skills, pathways, or identity as a person who has potential in STEM).
4. Participate in a Lesson Study with your team and WABS facilitators.
5. Submit the unit using the agreed upon format to WABS.
6. Present the unit at the May 2021 WABS Showcase for Success.

1 Torp, L., & Sage, S. (2002) Problems as Possibilities: Problem Based Learning for k16 Education (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development

**PBL Procedure[[1]](#footnote-0): What is in a PBL Unit?**

Use this page as a reference. The PBL procedure may be one lesson or may be the process throughout the whole unit. Lessons may focus on a small part of the procedure or highlight the iterative process needed to get closer to a solution**.**

**Understand the Problem*:*** Describe how you will launch your problem. In this portion of the unit, students will work towards a common understanding of what the problem is and what they need to know in order to solve the problem.

* Introduction / Problem launch
* Brainstorm what students know / Need to know
* Define / Refine the problem

**Explore the Problem*:*** How will students explore multiple ideas and pathways and challenge their current conceptions? How will all students access the information / context? Student groups will develop multiple solutions to the problem based on their evidence that will be shared in the next section.

* Gather information
* Share information
* Generate possible solutions

**Resolve the Problem*:*** Students should be able to provide an argument for each of the possible solutions and be given an opportunity to share and critique arguments. How will students reflect upon and share what they’ve learned? How will students synthesize their learning? If there are presentations involved with this PBL, how do you plan to help the non-presenters learn from presentations?

* Determine best fit solution
* Present the solution
* Debrief the problem

**Unit Overview**

**Title of PBL Unit: Sustainable Development**

Target Grade Level(s): Middle school (6-8)

Subject(s): Science and STEM

Author(s): Stephen Howard, Anna Jackson, Jenevive DeLazzari, Chris Mirecki

**Problem Statement:**

You work for a housing development company. A housing development is going into your community in an environmentally (and/or culturally) sensitive area. Imagine the community asked your architectural company to propose a house design that causes the least environmental damage and resource/energy use.

**Unit Overview and Table of Contents**

Students are assigned the task of understanding how different geographic regions have different sustainability limits and needs. In the PBL students will define and learn what “sustainability” means. Students will then work towards applying their learned knowledge of sustainability by engaging in the problem scenario, designing a house or housing development in a community that meets the community’s environmental needs and restrictions. Their work reflects knowledge of the importance of sustainability and the long-term positive impact of this form of building.∂

**Ideas and concepts students will learn**

* Define and apply the term sustainability.
* Learn about what it means to communities past and present.
* Learn about different building materials and requirements to meet sustainability guidelines.
* Explore sustainability in their personal lives to learn about their energy consumption.

**Practices students will develop/expand on throughout the unit**

* Critical thinking skills; observations and inferences, analyzing data, argumentation using evidence.
* Collaboration skills: small group discussion strategies, splitting work assignments with accountability.
* Presentation skills: verbal, written, and visual

**Outline and lesson goals**

| Outline | Goals |
| --- | --- |
| Task 1 - Understanding the concept of “Sustainability” | Students will create a working definition of the term, sustainability, and provide examples of sustainable practices/materials and examples of non-sustainable practices/materials. |
| Task 2 - Launching the Scenario and “What do we need to know?” | Students explore the location for the model housing development and in small groups agree on five topics to research about the location so begin their design process. Groups will present 10 facts from the research process to support their design process. |
| Task 3 - Case Study- Learning about “Green Building Design” | Students will learn about a variety of sustainability building techniques that they can use in the final design. |
| Task 4 - The Product- Creating your Green Building Design. | Students will build their sustainable house model and present their design to their class. |

[Task #1:](https://docs.google.com/document/d/1YQnUxn6Qwo2dGks5O7Odvxm1KuX9sTWsQ4tB49DoGEQ/edit?usp=sharing) Understanding the concept of “Sustainability”

[Task #2](https://docs.google.com/document/d/1G5Ms48w6-Lhg5cbFpFAhmBHgi-pDpAqmEVck0xj7CYI/edit?usp=sharing): Launching the Scenario and “What do we need to know?”

[Task #3:](https://docs.google.com/document/d/1A8Ls32CcnVHV6n2og1G_cf5G4H7s_SmwpdLCYh6jC-0/edit?usp=sharing) Case Study- Learning about “Green Building Design”

[Task #4:](https://docs.google.com/document/d/1iZDta9sBE9t0TKcAsXu0nhqjhyv6pO9qaLffRIknV6g/edit?usp=sharing) The Product- Creating your Green Building Design.

**Standards (NGSS, CCSS, CTE):**

**NGSS**

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

**CCSS**

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

**CCSS ELA-Literacy**

[RI.6-8.4](http://www.corestandards.org/ELA-Literacy/RI/7/4/) Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.

L.6-8.4 Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

W.7.6 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

**Soft Skills:**

Students will engage in the following 21st century skills:

Communication, Collaboration, Critical Thinking, Creativity, Social Justice, Equity

**EXTENSIONS**

Locally and/or Personally Relevant for Students:

* Although the PBL as written uses Juneau Alaska as the location for the housing design, teachers might consider looking for examples within or around your own community as the focus for the building design. This would allow students to learn about sustainability issues in different regions and communities.
* Teachers might bring in local architects, construction professionals, environmental engineers, city planners, and community leaders to add their expertise to the project and add career connected learning opportunities to the project.
* Add in a lesson of different sustainable techniques used by Native or Indigenous communities in the past. Have students explore traditional housing and how it incorporated sustainability or green building or eco-conscious building techniques from a historical perspective. Students can compare and contrast these traditional methods of housing from cultures around the world to modern housing.
* Students are presented with a sorting activity where they are presented with a variety of sustainability techniques and a variety of climates/geographic regions. Students should discuss the pros and cons of each technique and match it to an appropriate geographic region. (EG - students can determine if an underground home that functions to keep a home cooler in hot and dry climates would be a good “fit” for Alaska vs. bamboo houses on stilts being used in a wet climate like London.)

**Task 1: Understanding the Concept of Sustainability**

**Problem statement:**

A housing development is going into your community in an environmentally (and/or culturally) sensitive area. Imagine the community asked your architectural company to propose a house design that causes the least environmental damage and resource/energy use. Lesson 1 focuses on students exploring their conceptions of what sustainability means to them.

**Learning objectives:**

Students will create a working definition of the term “sustainability,” and provide examples of sustainable practices/materials and examples of non-sustainable practices/materials.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

**Soft skills:**

**Locally and/or personally relevant for students:**

Students should be encouraged to think about the concept of sustainability locally in their personal context first. What impact do their personal choices have on the environment around them? How do their school, homes, community demonstrate the concept of sustainability?

**Connections to career and educational pathways:**

Career connections and pathways in lesson one will be a secondary focus. As students brainstorm, discuss, and evaluate their thinking through the lesson, professionals and jobs identified by them can be cataloged in a parking lot.

**Materials/Tools:**

Padlet with opening discussion prompt

Slide deck - Which is more Sustainable?

Carbon calculator website link - <https://www.conservation.org/carbon-footprint-calculator#/>

Share Google docs or jamboards

**Lesson preparation:**

organizing materials and adjusting to the specific needs of your student groups.

**Time required:**

2 - 60 minute periods or 1 block

**Grouping of students for instruction:**

**Activity 1:** students will start individually to post to the padlet.

**Activity 2:** Slide deck presentation,[*Which is more Sustainable?*](https://docs.google.com/presentation/d/1-EfQkjpUkEyJe_ZeQQvQ95qUeNNaFBu-ZoPdcOCNogk/edit?usp=sharing), students will be grouped in 3-person groups with a shared document. The shared document will look like the table below. Students will each complete their column. The group will follow the instructions for the three roles, each taking a role.

| student name | student name | student name |
| --- | --- | --- |
| student choice | student choice | student choice |
| group consensus  (student name who is typing) | | |
| 2 slides group will share their thinking on  (student name who is speaking) | | |
| one slide that was challenging  (student name who is speaking) | | |

**Activity 3:** Students will individually explore the carbon calculator in class.

**Activity 4:** Whole class share/debrief

**Understanding the Problem**

| **Teacher** | **Student** |
| --- | --- |
| Activity 1 (focuses on ESS 3-4)   * The problem will be introduced on the slide deck, “what does sustainability mean?” * “Without looking it up, think about what this word means. Can you use it in a sentence?” What does it make you think of? * Instruct students to read other’s responses. * Teacher will facilitate a discussion on the student generated ideas. Discussion protocol used is a Think-pair-share | Individually brainstorm and generate ideas using a padlet app.  Students will engage in a Think-pair-share discussion protocol with the students to their right or left (based on room arrangement) |
| Activity 2 (focuses on ESS 3-4)   * Present the “Which is more Sustainable?” slidedeck?”. This slidedeck introduces juxtaposed images of sustainable vs. unsustainable life choices, prompting students’ responses. * (all responses are acceptable here) | Students generate responses from the slides.  After a slide is presented, students will move to the side of the room based on the image in the slide.  Students in small groups will discuss, agree, and then share why they chose the side they did.  Whole class discussion. |
| Activity 3 (focuses on ESS 3-4)   * Present the Carbon calculator. * Upon completion of the carbon calculator have students reflect on prompt examples:  1. How much carbon do they consume? 2. How do their choices impact carbon consumption? 3. What advice is given to reduce their carbon footprint? | Students will complete the carbon calculator  <https://www.conservation.org/carbon-footprint-calculator#/>  or  <https://kids.lovetoknow.com/kids-activities/carbon-footprint-calculator-kids> |
| Activity 4 (focuses on ESS 3-4)   * Revisit the padlet students generated at the start of the lesson. * Example prompt: What changes would you add to your initial idea of sustainability? | Students will engage in a reflection on how their understanding of the term sustainability has changed. |

**Accommodations:** Accommodations will be determined by the class make up. This first task has lots of opportunities for all students to engage at their readiness level. The main focus of the activities is it engages students in what sustainability means to them and their peers.

**Extensions:**

**Activity 2:**  students can come up their own examples to present to the class to lead the discussion.

**Activity 3:** Students can explore both carbon calculators provided as they each have a different lens of interpretation.

**Assessment:**

The formative assessment for this lesson will be activity 4. Students will review their initial idea of sustainability against their thinking at the end of task 1.

**Task 2: - Launching the Scenario and “What do we need to know?”**

**Problem statement:** You work for a housing development company. A housing development is going into your community in an environmentally (and/or culturally) sensitive area. Imagine the community asked your architectural company to propose a house design that causes the least environmental damage and resource/energy use.

**Learning objectives:**

By the end of this second Task (done over 2 days), students will be introduced to the “Design Challenge”, and will begin the process of discovering what they need to know to be able to approach the challenge in an intelligent way. By the end of this task, students will be able to ask questions about what they would need to know to accomplish the Design Challenge, begin to answer these questions, and share their answers collectively.

**Lesson standards (NGSS, CCSS, CTE):**

* MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
* MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
* MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

**Soft skills:**

Students will engage in the following 21st century skills:

Communication, Collaboration, Critical Thinking, Creativity, Social Justice, Equity

**Locally and/or personally relevant for students:**

Building and permit planners

civil engineers

**Connections to career and educational pathways:**

Architects

Building and permit planners

civil engineers

**Materials:**

Padlet on sustainability

Sustainable design overview slide

individual document on what do we need to know

**Lesson preparation:**

**Time required:**

2 - 60 minute periods

**Grouping of students for instruction:**

Students will be grouped based on instructor preference for group size and role assignments.

The assignment was implemented as an individual assignment in the remote learning environment.

**What is the instruction? Consider the PBL procedure that is being addressed here:** See the PBL procedure on page 2. Are students understanding, exploring, or resolving the problem in this lesson? Or, are they doing all 3? Explain what the teacher is doing and what the students are doing. This section should be written as if you were writing very detailed substitute plans. Teachers should be able to teach this lesson from all the information you provide without having to ask the author questions.

**Understanding and Exploring the Problem**

| **Teacher** | **Student** |
| --- | --- |
| Review the definition of sustainability that students developed in the last task. | Can the students recite it? Can they explain it? Can they provide examples to illustrate sustainable choices? |
| Ask the students if they know what an Architect is/what an architect does. Help them understand this career a bit. Tell the students that for this project they are going to pretend that they are professional architects and have been given a job to complete for their architect firm. Share with the students the [Sustainable Design Overview](https://docs.google.com/document/d/1NAzHGKWGeq29Hcd0uvHYuqmnAPJqcY5dsSU0ZAwqBWE/edit?usp=sharing). Go over all the requirements. | Students will learn about and be able to explain the profession of an architect.  Students will also learn about and be able to explain the requirements of the project. |
| Ask the students: “with only that information given to you, what are some things you would need to know to get started on your design?” | Students will generate a list of ideas and actions to get started on their design challenge. |
| Give the students the “[Individual document What Do We Need To Know](https://docs.google.com/document/d/1nn3sZDGQAs8Lcj5AuifjNctoLmsoHtnbbijtqcFpEqs/edit?usp=sharing)”. | Students will engage in the research aspect of the project. Students will do some initial research on Juneau/Auke Bay. They need to come up with 5 topics that an architect might want to know a bit about (some examples might be: weather, wildlife, earthquake risk, winds, population, soils, etc…). They should come up with one fact for each topic and explain why it might be useful for an architect to know this information if they were building a house in the area. |
| Review the definition of sustainability again. | Can they recite it? Can they explain it? Can they provide an example? |
| Review the Sustainable Design Challenge that they as architects need to do. Ask for clarifying questions | Students will check their understanding of the design challenge. Provide clarifying questions.  Have students in table groups share their 5 topics/facts/why important from the Individual What Do We Need To Know assignment they did the day before. Do they have things in common? Let them “teach” each other what they learned. After they turn this assignment in, as a teacher you might put them all in a “facts about Juneau/Auke Bay'' folder that kids can resource if they need to find some facts during their design process. |
| Show the kids the [video clip from Auke Ba](https://youtu.be/v12HOCvnDC0)y that the high school kids made up there. This might also be a good time to do a class on google earth and look at the area. | Students will ask clarifying questions and continue to clarify their thinking about the challenge. |

**Accommodations:** Accommodations can be in the form of structured documents for students needing guidance.

**Extensions:** Extensions could be for students to engage in local community research based on their location.

**Assessment:**

Assessment will be formative.

* Can students define, explain, and provide examples of the following terms:
  + sustainability
  + architect profession
* Can students explain the design challenge to each other and ask clarifying questions.

**Task 3 - Case Study- Learning about “Green Building Design”**

**Problem statement:** You work for a housing development company. A housing development is going into your community in an environmentally (and/or culturally) sensitive area. Imagine the community asked your architectural company to propose a house design that causes the least environmental damage and resource/energy use.

**Learning objectives:** Students will complete a case study to learn about a variety of sustainable building techniques that they can use in their own final design.

**Lesson standards (NGSS, CCSS, CTE):**

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

W.7.6 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

**Soft skills:**

Students will collaborate in groups each assigned with a different case study, which requires interpersonal skill sets and develops their work in communication while all working on one document and task to complete the research. Students can determine different roles within their groups, or each work independently and then come together to share their ideas and findings for the final product. This task also requires critical thinking because students must apply the class definition of “sustainability” to real-world examples and situations in order to determine features of sustainable design in their research.

**Locally and/or personally relevant for students:**

The teacher can adapt the “Case Study” assignments to reflect any examples of Green Building Design from local, cultural, or regional structures.

**Connections to career and educational pathways:**

Students will learn about design features of buildings that are sustainable, and so they will learn about career pathways in housing development and design (eg - architecture, draftsmanship, engineering, various certifications such as electrical or plumbing, etc.)

**Materials:**

Template for Students to Present Case Study Findings

Web Resources for Student Research

Case Studies (teacher provided list of building examples)

Sustainability Padlet for Reference

Teacher Provided Categories (defined) of Sustainability

Guiding Questions and Rubric for Case Study

**Lesson preparation:**

Prepare student groups

Prepare Resources for Student Research and Use

Set up classroom and/or Template for Group Collaboration

**Time required:**

1 class or block of time for students to research and collaborate

**Grouping of students for instruction:**

Students will be grouped heterogeneously based on the final padlet definition. Students should have at least one group member who has a strong understanding of sustainability. Teacher discretion can also make decisions regarding social combinations that will collaborate the best together.

Assigned case studies that do not have a strong personal connection to students based on geographic region may be considered for students who are strongest in understanding how climate impacts sustainable decisions.

**What is the instruction? Consider the PBL procedure that is being addressed here:** Students are going to be exploring possible solutions to the problem in this lesson. They can use ideas from this activity to help them finalize plans for their own personal design in the next lesson.

**Exploring the Problem**

| **Teacher** | **Student** |
| --- | --- |
| Review the class definition of sustainability and the padlet from previous lessons.  Introduce the three categories of sustainability:  \*fit  \*resources/materials  \*energy | Students can think-pair-share about each category and come up with an example of a feature in their personal home or of a building that would fall into that category. |
| Assign student groups and case study  Circulate to assist and facilitate positive collaboration | Collaborate in research.  \*Decide group roles  \*Begin research  \*Use teacher provided template to take notes |
| Provide time and format for students to present | Groups present Case Study to the class |

**Accommodations:**

**\***Provide partially filled in templates for ELL or SPED students.

\*Screencastify (or other video recording format) of reading aloud key parts of the web resources to help struggling readers access the information

\*Provide the option to only respond with images and not require any written text response

\*Allow students to respond either on paper OR electronically

**Extensions:**

\***Compare and Contrast Jamboard**

Students are provided with jamboard slides that provide web resources and images of traditional Native or Indigenous forms of housing, and then a second slide with a modern example of sustainable housing in the same geographic area as the historical example. Teachers can allow students to work on the electronic slides or print the slides out for them to record their research. Slides are intended to provoke exploration into traditional methods of sustainable design in Native American communities and to contrast these historical design methods with modern Green Building techniques. At the teacher’s discretion, the slides can be assigned to different groups and completed in jigsaw fashion, or assigned to individuals.

\***Sustainability Research Steps 1 and 2**

Students are provided with multiple web resources to reflect upon their own current consumption and carbon footprint, as well as to compare their current home with modern sustainable design elements presented through short video clips. After writing notes and reflecting on how their current lifestyle impacts the environment, students are given the opportunity to pick one website that they recognize as explaining all three categories of sustainability, and taking notes from their chosen website to explain how that building technique or design meets the criteria.

\***Geographic Matching Activity**

Students are provided with a chart that lists a variety of geographic regions representing varied climates and topography. Students are also provided with a list of “Green Building” techniques and resources. They must match each item from the list with a region, and then write a brief explanation justifying their choice. This can be completed online or on paper, and also in groups or individually.

**Assessment:**

**Rubric for Case Study**

|  | **4 Points -Exceed Standard** | **3 Points -Meets Standard** | **2 Points -Approaching Standard** | **1 Point - Does Not Meet Standard** |
| --- | --- | --- | --- | --- |
| **Research** | **Students are able to determine the features of the case study that show sustainability from the website, and may find an additional website (besides the one provided by the teacher) to expand their exploration.** | **Students are able to determine the features of the case study that show sustainability from the website and represent all 3 categories.** | **Students determine only limited features of the case study that represent sustainable design, or choose some features that do not meet sustainability categories.** | **Students are not able to determine features of the case study that represent sustainable design.** |
| **Content** | **Students use the template to record notes, both through images and written explanation; their notes show 4 or more sustainable features of the design they research.** | **Students use the template to record notes, both through images and written explanation; their notes show 3 sustainable features of the design they research.** | **Students use the template to record notes, but notes may only have images OR written explanation; their notes may not show 3 or more sustainable features of the design they research.** | **Students’ notes do not have adequate representation of sustainable features, either written or in pictures.** |
| **Presentation** | **All group members participate in sharing what they learned from their case study. They maintain a professional or serious stance while sharing their template with the class.** | **Most group members participate in sharing what they learned from their case study. They maintain a professional or serious stance while sharing their template with the class.** | **All group members do not participate in sharing what they learned from their case study. They may not maintain a professional or serious stance while sharing their template with the class.** | **Only 1 or 2 group members participate in sharing what they learned, and the behavior or attitudes of the group members during the presentation detracts from the presentation.** |

**Task 4 - The Product- Creating your Green Building Design.**

**Problem statement:** You work for a housing development company. A housing development is going into your community in an environmentally (and/or culturally) sensitive area. Imagine the community asked your architectural company to propose a building design that causes the least environmental damage and resource/energy use.

**Learning objectives:** Students will build their sustainable house model and present their design to their class. Students demonstrate understanding by developing and designing a sustainable house model to present.

**Lesson standards (NGSS, CCSS, CTE):**

**NGSS**

* MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
* MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
* MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
* MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
* MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

**Soft skills:**

Students will collaborate within their group to create a clear and persuasive presentation that explains their reasoning for the design features included in their building. Students can determine different roles within their groups, or each work independently and then come together to share their ideas and findings for the final product. This task also requires students to practice time management and decision making as they determine what should be included and work together to meet a deadline.

**Locally and/or personally relevant for students:**

Students have the option to connect their building design to the needs of their community or a sensitive community they feel connected to in another location, Ex. Auke Bay, Alaska

**Connections to career and educational pathways:**

Students will hear from an architect (guest speaker or video as available) about how to present a design proposal. The student presentation will be a culmination of their research into numerous career pathways (eg - architecture, draftsmanship, engineering, various certifications such as electrical or plumbing, etc.).

**Materials:**

Template for Students to Present Case Study Findings

Guiding Questions and Rubric for Case Study

Architect Guest Speaker and/or video

[Guidelines for Group Roles](https://pbs.twimg.com/media/ERq6nDHWAAUIMJz?format=jpg&name=4096x4096)

[Building Budget Sheet](https://drive.google.com/file/d/1DbHSFVBIYqG45tR2ZlXjrZUfTjKTQLMD/view?usp=sharing) (for hands on/physical building projects)

[Engineering a Sustainable Building Prototype](https://drive.google.com/file/d/1CfCh7MJmOJf6SfE528VL30y6UWxsK8ZX/view?usp=sharing)

[Design Scoring Matrix](https://docs.google.com/document/d/1FMzKYh4H7oEE4VO_YHLLhZNgljc-mNHBa5MP1pYF7iY/edit?usp=sharing)

[Sustainable Building SWOT Analysis](https://docs.google.com/document/d/145FCY-InZyGAgNJif_sHcM2_qQuMpirSSjMfyW3ZHsA/edit?usp=sharing)

**Lesson preparation:**

Student group roles

Schedule guest speaker via zoom or pre-recorded video

Review each group’s template for Group Collaboration

**Time required:**

2-3 class periods for presentation creation (fewer if work is possible outside of class)

2-3 class periods for class presentations (unless students pre-record their presentation)

**Grouping of students for instruction:**

Students will continue to work in the groups previously selected. Group roles for the presentation will be suggested and the rubric will require that all students in the group have a speaking part in the presentation.

**What is the instruction? Consider the PBL procedure that is being addressed here: Students will build their sustainable house model, create a presentation and then present their design to the class.**

**Problem-solving**

| **Teacher** | **Students** |
| --- | --- |
| Lesson 4.1  Using your research your team will design a sustainable building that meets your project budget,  and as many of the other requirements stated in the case study as you are able to meet.  Pass out Building Budget Sheet (if creating physical prototype) | Using - Engineering a Sustainable Building Prototype worksheet  Independently: 1. students describe the problem and why sustainable buildings are important.  Class (or small group) discussion: 2. determine success criteria and 3. constraints  Independently: 4. students use their past research to identify the most important sustainable design features, and 5. sketch two *different* sustainable building designs  Small Group: students take turns presenting their designs to the group. After all designs have been shared, students identify/list/circle at least one feature from each design they think should be included in their group prototype building.  Small Group: Use budget sheet to determine initial materials |
| Lesson 4.2  Review Group roles and facilitate a discussion in small groups | What went well yesterday/last lesson? What would you like to do differently on build day 2?  Small group: Work time |
| Lesson 4.3  Guest speaker or video on how to present a building design | Small group: Identify key parts of building design that need to be included in the presentation and determine which team member will present each part and in what order. |
| Lesson 4.4  Pass out - Sustainable Building SWOT Analysis  Presentations  Teacher uses the Design Scoring Matrix to score all designs | Students either present their building design to the class or record their presentation and post the video for the class to watch independently. Each student must complete a SWOT Analysis on their own design and at least \_\_\_\_ (1, 2 or 3) SWOT Analysis on other group’s designs. |

**Accommodations:**

Accommodations will be determined by the class make up. This task provides opportunities for all students to engage at their readiness level.

**\***Provide partially filled in templates for ELL or SPED students.

\*Screencastify (or other video recording format) of reading aloud key parts of the web resources to help struggling readers access the information

\*Provide the option to only respond with images and not require any written text response

\*Allow students to respond either on paper OR electronically

**Extensions:**

If time allows, have students review all designs, noting features that would improve their building and then in the small group revise their design to rebuild a second prototype. If possible have an architect or city planner review the designs and/or presentations and give feedback for some or all of the designs.

**Assessment:**

Fill-in any criteria identified by the group into the Design Scoring Matrix and then use the matrix to score the sustainability of each design. Students will peer assess their own group and at least a couple of other designs using the SWOT Analysis.

1. The sub-sections of the procedure section (e.g., Understand the Problem, Explore the Problem) are from the Illinois Math and Science Academy’s PBL Teaching and Learning Template. The descriptions were developed by WABS and do not necessarily represent the views of IMSA. [↑](#footnote-ref-0)