TOP | TRANSATLANTIC OUTREACH PROGRAM

STEM

“GREEN” ARCHITECTURE

Redesigning Buildings in Our Community

High School

“Green” Architecture: Redesigning Buildings in Our Community

Next Generation Science Standards	**HS-ETS1-2**
Materials Needed	• Student Devices • Rulers or architect scales • Paper, preferably 11x17 inch paper for floor plan drawings • Pencils • Drawing tools such as compass, triangles, etc. • Alternative to hand Drawing tools would be using CAD software.
Phenomenon	
Engage	Students will explore the Innovative Mercedes Benz Museum in Stuttgart and its connections to its community's past. Why would any building ever need an indoor tornado?
Explore	Students will learn about several examples of run-down buildings being turned into new innovative designs. Students will then work in groups to identify properties that they themselves can redesign to better serve their community.
Featured Sources	• Architecture. ZKM. (n.d.). https://zkm.de/en/architecture • BigRentz. (2023, April 12). Floor plan symbols, abbreviations, and meanings. https://www.bigrentz.com/blog/floor-plan-symbols?srsltid=AfmBOorZmF0aQWXIYKHjlQ-oKDNjdahGGMEnHLouegBCt1s1Ue1inzH9 • Leiva, S. (2020, August 21). Participatory student building project spinelli mannheim / atelier U20. ArchDaily. https://www.archdaily.com/805475/participatory-student-building-project-spinelli-mannheim-atelier-u20 • Mercedes-Benz Museum. UNStudio. (n.d.) https://www.unstudio.com/en/page/12482/mercedes-benz-museum • Mercedes-Benz Museum - World’s highest artificial Tornado. YouTube. (n.d.). https://www.youtube.com/watch?v=DvK8D0VNumQ • Über die Halle. Perfekt Futur. (n.d.). https://perfekt-futur.de/ueber-die-halle/
Featured Sources	• Mercedes Benz Museum Investigation Worksheet • Floor plan & elevation view Presentation • Repurposing Karlsruhe Activity Sheet • Design Challenge Brief
Explain	Students will work in groups to research their own community to look for potential buildings to renovate.
Create a Prototype	Students will create floor plans, elevations views, and a presentation of their design ideas.
Elaborate	Students will create plans for their repurposed building designs with their groups.
Evaluate	Students will present their work to the teacher and the class and get feedback from both on their designs.

Phenomenon

Humans have always depended on their creativity and resourcefulness to create structures that provide a service to the community. Germany presents a number of interesting building designs that we can look to for inspiration. Including examples of buildings that have been repurposed or redesigned to fulfill a purpose that is different from their original intended use. How can you, as future engineers/architects design and/or redesign buildings to better serve your community?

Target Grade Level: 11/12	Target Course: Technology Education/Engineering

Inquiry Overview

In this lesson, students will explore several examples of unique building designs in Germany that focus on repurposing old structures and/or innovative ideas in building design. Through studying these examples, students will learn that there can be much more to a building than just walls and a roof. Students will then look to their own community for examples of a building that could be repurposed. Students will work in teams to develop a proposal detailing their own innovative ideas for this building.
This proposal will include a detailed set of floor plans and elevation views created bynthe students to fully communicate their design concepts.

Teacher Background Information

The example buildings that are the focus of this lesson are just a small sample of the many unique and innovative designs located throughout Germany. Another repurposed building teachers may want to include in the lesson is the Elbphilharmonie Hamburg, which is a warehouse that was renovated into a unique concert venue. Consider having students do their own search to identify even more of these examples throughout Germany.

This lesson is meant to be taught in a technology education course. There are many different technology education courses focused on different subjects but many require students to work through the design process and produce plans to communicate their design ideas. Unless this lesson is being taught specifically in a civil engineering & architecture course or another course that requires students to use CAD software, students should not be expected to produce professional quality plans. This lesson is meant to be more of an introductory lesson to floor plans and elevation views and creating a design proposal to communicate ideas. Students should however use drawing tools and standard floor plan symbols shared in the lesson to help them create neat and organized plans of their design ideas. If you want to dedicate more time to this project and if you have the tools, you could ask students to develop scale models of their designs. I would have students use tools like 3D printers, laser cutters or even just cardboard to create scale models. In my experience visiting Germany, many of the places we visited had various types of scale models of their facilities. One business had a scale model made from Legos, another had a massive scale model of their entire campus.

Suggested Time Frame

Approximately 10 45-minute class period

Concept List

- Floor planning
- Elevation Views
- Building design
- Architecture
- Drawing tools/symbols
- Innovative building design
- Community impact

Materials Needed

- Student Devices
- Rulers or architect scales
- Paper, preferably 11x17 inch paper for floor plan drawings
- Pencils
- Drawings tools such as compass, triangles, etc.
- Alternative to hand Drawing tools would be using CAD software.

Featured Sources

- Mercedes Benz Museum Investigation Worksheet
- Floor plan & elevation view Presentation
- Repurposing Karlsruhe Activity Sheet
- Design Challenge Brief
- Architecture. ZKM. (n.d.). https://zkm.de/en/architecture
- BigRentz. (2023, April 12). Floor plan symbols, abbreviations, and meanings. https://www.bigrentz.com/blog/floor-plan-symbols?srsltid=AfmBOorZmF0aQWXIYKHjlQ-oKDNjdahGGMEnHLouegBCt1s1Ue1inzH9
- Leiva, S. (2020, August 21). Participatory student building project spinelli mannheim / atelier U20. ArchDaily. https://www.archdaily.com/805475/participatory-student-building-project-spinelli-mannheim-atelier-u20
- Mercedes-Benz Museum. UNStudio. (n.d.) https://www.unstudio.com/en/page/12482/mercedes-benz-museum
- Mercedes-Benz Museum - World's highest artificial Tornado. YouTube. (n.d.). https://www.youtube.com/watch?v=DvK8D0VNumQ
- Über die Halle. Perfekt Futur. (n.d.). https://perfekt-futur.de/ueber-die-halle/

Next Generation Science Standards (NGSS) / State Content Area Standards

- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Outcomes for Student Learning

- Students will be able to create floor plans using standard symbols and tools
- Students will be able to create elevation views of a building design.
- Students will work in groups to complete an engineering design challenge for their own community.

Germany-Related Learning Goals

- Identify 3 or more examples of innovative buildings in Germany and the inspiration or community need that drove the design of those buildings
- Explain the connections that Stuttgart, Germany has with the Automotive Industry as well as the history of the invention of the automobile in this area.
- Explain the purpose of the ZKM Center for Arts and Media and the Perfekt Futur Startup center and the history of the buildings that they are housed in.

Phenomenon / Main Problem

Humans have always depended on their creativity and resourcefulness to create structures that provide a service to the community. Whether it be early structures that were little more than shelter from the elements or modern day buildings that provide innovative solutions to modern day problems, we can look to these examples to spark our own creativity and create unique buildings that solve needs in our communities. Unfortunately, sometimes buildings that are originally designed for a specific purpose end up being abandoned and left to deteriorate. Sometimes even causing safety concerns. Germany presents a number of interesting building designs that we can look to for inspiration. Including examples of buildings that have been repurposed or redesigned to fulfill a purpose that is different from their original intended use. How can you, as future engineers/architects design and/or redesign buildings to better serve your community?

Engage

Day 1: Mercedes Benz Museum Investigation

- The teacher will begin the lesson by showing the Mercedes Benz Museum Artificial Tornado video.
- Students will begin this unit by investigating the building design of the Mercedes Benz Museum in Stuttgart, Germany.
- Students complete the Mercedes Benz Museum Investigation assignment that is provided with this lesson plan.
- Students will be asked to examine online sources to answer questions about the unique features of the building design.
- At the end of the period, have a class discussion about the investigation questions and provide further answers from the answer key if students did not find all of the correct answers.
- Explain to students that in this unit, they will be investigating several interesting building projects, and they will be looking to their own community to select a building that could be reimagined to better serve their community.

Anticipated Guiding Questions

1. How can you, as future engineers/architects design and/or redesign buildings to better serve your community?
2. How can you communicate your design ideas to other people?

Explore

Day 2: Elevation Views and Floorplans

- This class will provide students with the basics of creating floorplans and building elevation views.
- The teacher will show students several examples of elevation views and floor plans.
- The class should discuss any common symbols or things that they see as they look at these examples
  - Share the provided Floorplan and Elevation Views Basics Presentation with the class.
- Students will create a rough floor plan and elevation view drawings or a building of their choosing. This could be any building, but it should be a relatively small and simple building. They could use their house, a restaurant, or any building they are familiar with. The drawings do not need to be perfect as this is just to practice floor planning and elevation view basics.

Day 3: Repurposing Karlsruhe

- During this class students will explore several examples of buildings in Karlsruhe Germany that have been repurposed from their original purpose. Before being repurposed these buildings were abandoned and fell into disrepair.
- ZKM Center
- Perfekt Futur Startup Center
- The instructions are available to download in PDF format

Day 4: Identifying Potential Projects

- In this lesson, students will begin searching their community for potential buildings that could be repurposed into something useful to the community. The focus of this search should be old, abandoned, or underutilized buildings. The focus of the project is to take a building that no longer serves much purpose and turn it into a plan for a building that fulfills a need in the community.
- The teacher should go over the design challenge guide (provided as a PDF) with the class that explains the criteria for this project.
- Students will work in small groups to brainstorm a list of potential properties to use as the focus of this project. They should discuss properties that they may already know of in the community and use google maps to search out others that may be potential sites for improvement.
- The teacher should identify a few properties or areas of the local community that could use some updating or renovating. The teacher can share some of these ideas with the students if they are struggling to identify any potential sites to select for the project.

Explain

Day 5-6: Project Brainstorming & selection

- Student groups will spend time brainstorming ideas for how they can repurpose the building that they have chosen for this design challenge.
- Students should work in their groups to discuss what they want to do with their buildings and how their project would be beneficial to the community,
- The class should discuss concept sketching and define the meaning of building elevation views.
- While brainstorming, each student should create their own concept sketches to help communicate their ideas to their partners and others.
- Each group will decide on one final design idea to turn into a more detailed proposal. As a group they should decide which project ideas would be the best for the community
  - Consider having students create a decision matrix to help them decide which project would be the best based on multiple factors.

Explain Cont'd

Project Inspiration: German Architecture Student Design

- At the start of one of these two class periods the teacher should share and discuss this article with the class. https://www.archdaily.com/805475/participatory-student-building-project-spinelli-mannheim-atelier-u20
- This article shows an example of how students can make a positive impact in their community. A group of architecture students in Germany created a unique design for a community center for refugees. Although it is not a repurposed building, it shows the powerful work of students. Perhaps students in this class could present their ideas to a town council, maybe it could turn into a real project, who knows!

Create a Prototype

- Completing the project in this unit does not require a prototype but it does require students to develop their own design plans. The project could be taken a step further by asking students to create a scale model of their design idea or if students are experienced with CAD software they could create a CAD model of their designs.

Elaborate

Days 6-8: Create Plans

- During these class periods students will work in their groups to create floorplans and elevation views of their redesigned building plans. As they finish their plans, they will also develop a short presentation to share their design proposal with the class.
- Each group will produce a final detailed floorplan with notes and symbols and a north, south, east, and west elevation of the building to show what the exterior will look like.

Evaluate

Days 9-10: Present your Proposal

- Students will present their project ideas to the class today. Each group will be given some time to explain the building that they chose, how they chose to repurpose it, and the plans that they created.
    - Time should be provided for other groups and the teacher to ask questions about the designs.

Virtual Exchange

An idea for a virtual exchange for this unit would be to work with a class in Germany to complete this same unit. However, the class in Germany would start by examining unique examples from the participating classes' local area (state, country, etc). At the end of the project, students could prepare video presentations of their design ideas that could then be shared with the students in the participating class.

Career Connection Exploration

Essay / Presentation	Students could present their design ideas to community members in relevant careers such as civil engineers, architects, etc. with the intention of receiving professional feedback on their ideas. These individuals could provide students with insight that they may not have considered before. This could also give students an opportunity to ask these individuals questions about their career path and education.

Modifications for Differentiation

This lesson could easily be adapted for younger students by simplifying the expectations for the floor plans and sketches. Students in more highly specified tech programs may be able to create models/designs using CAD software in addition to floor planning and sketching elevation views. Another opportunity for differentiation would be to allow students the options to create a physical model of their design for which the expectations could again be tailored to the age group and skill level of the given class. Scale models of buildings and campuses are common in Germany as well.

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