Facilitation Guide: Accessible Innovations with Universal Design

Challenge

Students will develop their empathic design and innovation skills by redesigning a common product to be more accessible. They will use universal design principles and Glowforge technology to prototype their product.

Rationale

This challenge helps students develop their empathetic design skills and explore universal design principles. Through the redesign of a common product, they will create safer, more enjoyable, and more accessible products, gaining valuable experience in problem-solving, critical thinking, and meeting customer requirements. By conducting research, testing the product with users, and identifying necessary changes, they will learn about the importance of thorough planning, communication skills, and attention to detail.

Students will acquire skills in research, design, project management, communication, and problem-solving. They will also learn about incorporating universal design principles to reach diverse customers. By the end of this challenge, they will be able to apply alternative manufacturing processes to improve product production in a real-world setting.

Glowforge can create customized parts and components for the redesigned product. It can produce specific design features to meet the needs of different user groups, making it a valuable asset in this manufacturing challenge. By using Glowforge to create prototypes, customize products, and manufacture parts efficiently and cost-effectively, students can bring their design ideas to life and gain practical experience in product manufacturing.

Standards

Common Career Technical Core Standards

- MN-PPD 2. Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- MN-PPD 5. Develop procedures to create products that meet customer needs.

ISTE Standards for Students

- Innovative Designer 1.4a: Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
- Innovative Designer 1.4c: Students develop, test and refine prototypes as part of a cyclical design process.

Facilitation Steps to Support the Design Process

DESIGN STAGES

Explore → Ideate → Design → Prototype → Evaluate

Iterate
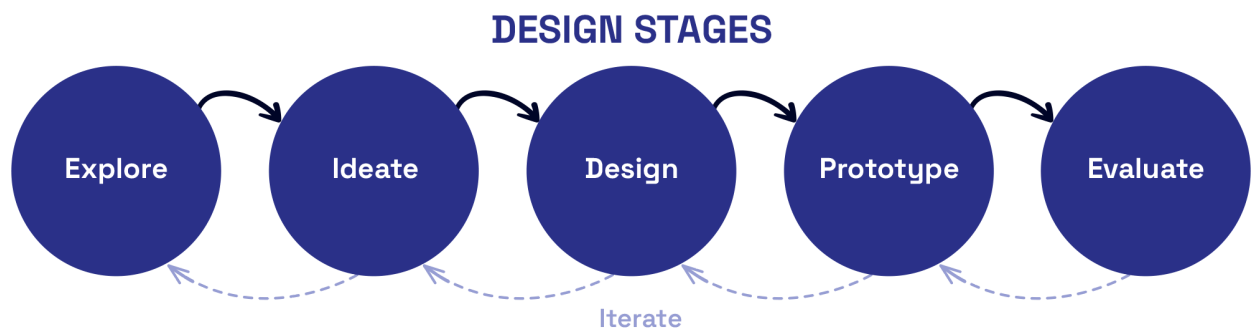
Explore

In the Explore stage, students focus on researching and investigating universal design and consider products to redesign. To prepare students for this stage, follow these steps.

1. Provide students with resources and a brief introduction to universal design.
   - Encourage students to engage with articles, websites, and videos to learn more about universal design and how it helps all users.
     - Rick Hansen Foundation Universal Design 101
     - The 7 Principles of Universal Design
     - Accessibility is Beautiful Home design series
   - Help students brainstorm products we use everyday that have been created using universal design principles. This website has a few inspirational cases to get you started.
2. Facilitate research and reflection by providing options for students to document and organize their research findings. This could be digital or in a graphic organizer.
   - Ask students how their research and findings influence their incorporation of universal design principles.
3. Offer feedback and guidance by helping students refine their research questions or identify new areas of inquiry. Ask students:
   - What did you learn during your research?
   - How did your research influence how you understand this challenge?
   - How did your research help you brainstorm for a redesigned, user-friendly product?

- How did your research help you understand universal design and its importance?
4. Foster discussion and collaboration among students, classes, or experts.
    - Encourage students to share and build on each other's ideas.
    - Ensure that all students have a voice and an opportunity to participate in the discussion.

At the end of this stage, students will reflect on their research about universal design. Encourage them to consider how insights from their research can help generate ideas for their product.

Before moving on, students should consider any other helpful resources or techniques to explore. Once finished, students will proceed to the Ideate stage and brainstorm about redesigning a product using the principles of universal design.

Ideate

In this stage, students will brainstorm and experiment with different ideas for redesigning their product. Here they can explore as many ideas as possible without judgment. Remind them to consider how their ideas will make the product safer, more enjoyable, and easier to use. To prepare students for this stage, follow these steps:

1. Facilitate brainstorming activities to help students get thinking creatively. Try one of the following methods or use your own.
    - SCAMPER: SCAMPER stands for Substitute, Combine, Adapt, Modify, Put to Another Use, Eliminate, and Reverse. Using these prompts, students can brainstorm about modifying or adapting a product to make it more accessible.
    - Reverse Brainstorming: Ask students to imagine how they'd make a product inaccessible or exclusive. Then have them flip those ideas to make the product more accessible.
2. Help students evaluate their ideas to focus on the best solutions. Ask them:
    - Which ideas are the most cost-effective and realistic or most likely to be successful?
    - Which are most aligned with the project's goals and objectives?
    - Which are most likely to meet the needs of the target user and appeal to a wider audience?
3. Champion and support divergent thinking. Ask open-ended questions, challenge assumptions, and suggest alternative perspectives. Use questions like:
    - What if you combined this product with another product?
    - What if you used a different material?
    - What underlying need or desire does this product address?
    - What are some potential benefits or drawbacks of different approaches?

At the end of this stage, students will have generated multiple redesign ideas and can begin to develop one that incorporates universal design principles.

Before moving on, students should consider which parts or components they will need to design using Glowforge. Once finished, students will continue to the Design stage, selecting one or two ideas for further development.

Design

In this stage, students develop their ideas from the Ideate stage to draft a detailed plan for their redesigned product. Students should focus on one or two ideas to better understand their needs and final design. Encourage students to consider both the functionality and aesthetics of their design. To prepare students for this stage, follow these steps:

1. Provide students with question prompts from the Design stage of the challenge to help inspire their work.
2. Ask students to compare their redesign to the original. Have them explain why their design is easier and safer to use. Use prompts like:
   - What features or elements of your design make it easier and safer to use?
   - What are some common issues that people have when using the product in its original design? How does your design mitigate these challenges?
3. Introduce, review, or model available design software options, including the Glowforge App.
   - Assist students as they create sketches or digital mockups of their redesigned product.
   - Remind students that Glowforge can engrave from JPG or PNG image files and cut or engrave from SVG and PDF files. Students can create a design in software that they already use, convert it to one of the supported file types, and print using Glowforge.
   - Review page 28 in the Glowforge Educator Guide for more software tools and information.
4. Ensure that students have a clear understanding of the design, materials, and tools needed to create a working prototype.
   - What materials and tools will you need to create your prototype?
   - What challenges or limitations might arise during the prototype stage?

At the end of this stage, students will have a detailed plan for their product redesign, including sketches or digital mockups, and be able to explain how their redesign makes the product more accessible.

Before moving on, students should consider if they would like to revisit their design. Once finished, students will continue to the Prototype stage to select, build and test one of their fully developed designs.

Prototype

In this stage, students will print and assemble their redesigned product according to their design plan. Students will select one plan, print parts on the Glowforge, and test their plan. To prepare students for this stage, follow these steps:

1. Model using Glowforge safely and efficiently.
   - Review the [Glowforge safety guidelines](#).
   - Remind students of any applicable classroom or school policies.
   - Use this [video](#) to demonstrate how to use Glowforge.
2. Ask questions to help students develop their prototypes. These might include:
   - What are the pros and cons of using different materials and techniques? What materials help you maintain functionality and also fit your aesthetic?
   - What other materials might work better or improve accessibility and customization?
   - How can you improve your design?
3. Give students the time and resources needed to print Glowforge elements for their product, assemble it, and test their finished prototype.
   - Create a classroom print schedule so all students can have their turn.
   - Provide art supplies for more aesthetic choices.

At the end of this stage, students will have a finished prototype that is functional and attractive. Their final product should incorporate the principles of accessibility and universal design.

Before moving on, students should review their finished print. They may need to test multiple times or revise earlier decisions. Once finished, they'll continue to the Evaluate stage and get feedback.

Evaluate

In this stage, students will evaluate their redesigned product and receive feedback from others. Feedback can be provided in pairs, small groups, or as a whole class. Encourage students to reflect on their process and consider their alignment with their original intent. To prepare students for this stage, follow these steps:

1. Prompt students to help them think about their product.
2. Encourage them to share and discuss their ideas to generate feedback from their peers.
   - Students can use the question prompts from the Evaluate stage to guide their discussions.
   - Use a peer-feedback model, such as a gallery walk, affinity mapping, or a concentric circle discussion, to support students as they work in pairs, small groups, or as a whole class.
3. Prompt students with questions to help them reflect on the feedback they received. These might include:
   - How could you further improve accessibility?
   - Where in the design process would you like to make more changes?
4. If applicable, let students complete a learning reflection, self-assessment, and/or peer critique.
   - Use the provided Assessment Suggestions for more ideas.

At the end of this stage, students will recognize strengths and areas for improvement in their redesigned product. They should recognize any necessary revisions and adjust their prints appropriately. Consider assessing student work using one of the Assessment Suggestions or extending the challenge using provided Extension Activities.

Supplemental Supports

- Use these product case studies from The RL Mace Universal Design Institute to examine the role of universal design in the development of several successful product designs and redesigns. These cases can get students to consider many issues designers and manufacturers might face.
- Want to help students think about others' perspectives when it comes to disabilities? These six posters from Gov.uk lists the dos and don'ts on designing for accessibility.
- For students looking to add joinery or movable elements to their packaging, introduce them to The Miracle Hinge or Noticing Patterns lessons about hinges and gears. Students can also use this guide to learn more about printing joinery. Check out how to create a living hinge with the help of Glowforge TV or the Glowforge Community.

Assessment Suggestions

Overall Learning Reflection

Learning reflections allow students to reflect on their learning experiences, identify key concepts, and explain how they have grown throughout the process of creating a universally designed product. Ask students to write or record a video about what they learned and how their learning will impact them and their ideas for future design projects. How did it change their perspectives on universal design? Students can incorporate feedback elements from the Evaluate stage to describe their strengths and areas for improvement.

Self-Assessment

Self-assessments allow students to reflect on their learning through portfolios, presentations, or learning journals that involve evaluating their own progress and identifying areas for improvement. Consider providing criteria to students before beginning the challenge, so they can reflect on their progress throughout. The criteria may include:

- Usefulness: Does the redesigned product solve a problem? Is it practical and functional for its intended use?
- Creativity and Originality: Did you come up with an innovative solution that demonstrates creativity, originality, and resourcefulness?
- Universal Design: Does the product meet the principles of universal design, making it accessible for all users?
- Aesthetics: Is the product visually appealing, well-designed, and aesthetically pleasing?
- Quality: Is the prototype well-made, durable, and constructed with quality materials?

- Cost: Is the prototype cost-effective to produce at a reasonable cost, and is it practical to manufacture on a larger scale?
- Presentation: Did you effectively communicate the purpose, design, and benefits of your product, both verbally and visually?

Educator or Peer Assessment

Educator or peer assessments allow educators or students to review the quality and effectiveness of the finished redesigned product. The assessment can be based on criteria listed below or use a more open approach, like a gallery walk or artist showcase. In addition to the self-assessment criteria, the evaluator might also want to consider:
- Creativity and Innovation: How creative was the product redesign and the incorporation of universal design principles?
- Attention to Detail: How much attention was paid to the details of the design, such as the material quality and the product's finished look?
- Reflection and Improvement: How did students reflect on their design process and identify areas for improvement? Did they use feedback from others to improve their design? What changes would they make if they were to do the challenge again?

Extension Activities

Design challenges often inspire students to think about what's next. For some, this could mean connecting with professional product designers or applying their skills in new ways. Here are a few ways to help students extend this challenge:
- Encourage them to advance their involvement in universal design. They can investigate universal design, accessibility, and inclusivity through research and inquiry. Have students identify inaccessible areas within the community by surveying, interviewing, or conducting usability tests. Then students can build solutions that enhance accessibility in playgrounds, public transportation, or other public spaces.
- Host a forum for the local chamber of commerce or manufacturing organizations that showcases students' research findings and prototypes, and addresses accessibility challenges in the community. Students can partner with local advocacy groups to raise awareness about the issue. During the presentation, students can co-present with representatives from these groups about the importance of universal design.

If your students enjoyed this challenge, they might also enjoy Level-up for Lefties, where they can redesign a common product to be more efficient and enjoyable for lefties.

Ready to take students to the next level? Try the Capstone Challenge: Sustainable Strategies for Circular Design, where students redesign a disposable product to incorporate circular design principles for manufacturing.