TECH TIP: Design Challenge Assessment

The Innovation Design Process provides opportunities for learners to develop critical problem-solving skills as they navigate engineering design challenges. This Assessment Tech Tip provides tools for assessing and supporting learners in developing their design process skills, innovator mindsets, and connected academic skills and content.

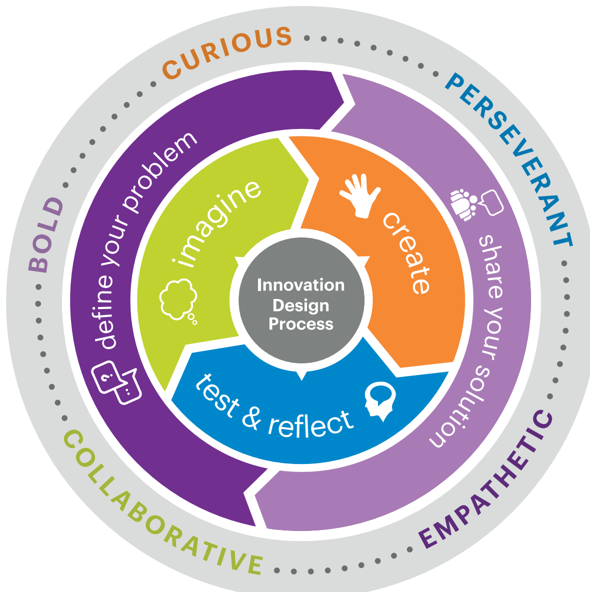
When assessing design challenge learning, keep these recommendations in mind:

- Focus on the process over the product, as a design failure will inform learning.
- Use authentic assessments that apply learning to a real-world context.
- Choose (and customize) the right assessment tools for your learning goals.
- Provide opportunities for learner self-reflection.

WHAT TO ASSESS

One of the first questions educators often ask when considering how to evaluate design challenge learning is "What should I assess?" Within design challenge learning, there are three main areas to consider for assessment; you might focus on just one area at a time or assess them all during a design challenge.

- **Design Process:** Since the design process is open-ended and iterative, remember to focus on *how or why learners developed their solution rather than looking at the final product*.
- **Innovator Mindsets:** Student reflections on mindset and a real-world context for design challenges encourage them to connect their academic growth to their own experiences and goals.
- **Academic Skills and Content:** Students can be called upon to show knowledge of various skills and concepts in their solutions and process. Ask yourself, *How did learners connect their design with concepts in science, social science, or math? How did learners demonstrate 21st century skills as they developed their solution?*



Innovation Design Process	Innovator Mindsets	Other Academic Skills and Content
Skills to navigate the **innovation design process** **Connections to:** • Engineering progression in the Next Generation Science Standards (NGSS)	Development of **Innovator Mindsets:** • Bold • Curious • Collaborative • Perseverant • Empathetic **Connections to:** • Social Emotional Learning (SEL)	How **other academic skills and content** are used throughout the design process **Connections to:** • Language development (ELA) • Math • Science • Social Science • 21st Century Skills

Tip: If you're new to engineering and design challenges, try focusing on the design process first, then layer in mindset and content as you and your students are feeling more comfortable.

EXAMPLE: ASSESSMENT DURING PROTOTYPING

Learners may:		
Test to determine the properties and characteristics of different materials.	Explore many ways to use materials as a practice in **curiosity**.	Use sentence frames to **compare and contrast** different materials that can be used as connectors.
Educators can:		
Review learner journals in which they document observations during testing.	**Observe learners** during build time.	**Observe learners' discussions** as they build and test.

Content Connections

Below are some examples of how application of core content can be integrated into the Innovation Design Process.

Define the Problem	Test & Reflect	Share Your Solutions
Language Development • Exploring alternate solutions to a character's problem from a book **Math** • Using scale to define the appropriate testing specifications **Science** • Investigating problems based on phenomena **Social Science** • Studying a human problem from history **21st Century Skills** • Critically thinking about all of the parts of a problem	**Language Development** • Recording qualitative observations **Math** • Measurement • Data analysis **Science** • Using science practices to conduct testing **Social Science** • Using historical examples or context to inform design **21st Century Skills** • Creatively iterating on their design	**Language Development** • Oral or written communication • Persuasive writing **Math** • Data representation **Science** • How knowledge of phenomena influenced designs **Social Science** • Forming conclusions about how the past is different from the present **21st Century Skills** • Communicating to peers about their ideas and justifying their designs

Developing and assessing **Computational Thinking** skills can be folded into the innovation design process since students are decomposing problems, using abstraction to evaluate prototypes, looking for patterns in testing and explaining how their designs work. See our Computational Thinking Tech Tip for more details.

HOW TO ASSESS

Once you have a sense of what to assess, it's time to focus on how you can support your learners in these goals and evaluate their progress. This can be done with an overall framing of an authentic assessment supported by observation and rubric tools.

Authentic Assessment

The multi-faceted, real-world nature of design challenge learning lends itself well to authentic assessment. An authentic assessment is a method of evaluating learning that has students step into the role of the expert and present conclusions from their design process to a relevant audience in a realistic way, such as writing a proposal, designing an ad campaign or creating a manual for their design. Anchoring a design challenge to a real-world problem increases engagement, builds empathy and helps learners to see themselves in a variety of often unseen careers.[1]

When using an authentic assessment, develop a real-world design scenario or story in which learners will take a professional role. Then, think through the related real-world tasks and products that learners will create in order to demonstrate their skills, mindsets and content mastery. In addition, have peers or invited guests act as the professional audience who will review and provide feedback on these products.

Design Scenario	**Authentic Assessment Task**	**Professional Role** (the role played by learners)	**Audience Role** (the role played by peers, family, and invited guest professionals)
Design a device to deliver essential medical supplies to a stranded hiker awaiting rescue.	Persuade search and rescue teams to carry this device in all of their vehicles.	Mechanical engineer	Search and rescue organizations
Design a computer program to model the environmental and economic impact of building a reservoir.	Argue for or against the dam based on research and data from the computer model.	Software engineer	City Council, community members

1. Authentic Assessment, Stiggins, R. J. (1987). The design and development of performance assessments. Educational Measurement: Issues and Practice

ASSESSING THE DESIGN PROCESS AND MINDSETS

Learning can be assessed via a culminating, summative assessment like a student showcase or gallery walk. But we also encourage smaller, more frequent assessments as students design, build, test, and share their prototypes. Student products like journals and share-outs can give insight into the students' process, skill acquisition and mindset development.

Student Products	**Innovation Design Process** Educators might look for:	**Innovator Mindsets** Educators might look for:
Journal	• multiple ideas explored • labeled drawings • testing records, data, planned iterations	• out-of-the-box ideas (bold) • design changes based on device failure points (perseverant) • input from whole team (collaborative)
Collaborative work time	• Sharing and eliciting ideas • Iteration based on testing	• active listening (empathetic) • inclusive behaviors, incorporating ideas of others (collaborative)
Share-outs	• clear description of process • iteration based on testing • thoughts about improvements that could be made next • comparisons made to other designs	• design changes based on device failure points (perseverant) • all team members sharing (bold/collaborative) • suggestions for future iterations from other teams (collaborative)
Team discussion during testing	• clear idea of intended function • identification of failure points • communication of next steps	• "What if we..." (curious) • "Let's try..." (bold) • input from whole team (collaborative)
Self-reflections	• recognition of where they are in the design process • reflections on design process traced on the Innovation Design Process graphic	• focus on growth over time (perseverant) • self-awareness of mindsets • feedback on the activity (bold)
Authentic assessment products	• definition of the problem in a real-world context • clear communication of design decisions and justification supported by evidence from testing and feedback	• improvements made to the design based on failure (perseverant) • connections with classroom content and life experience (curious/bold) • understanding user needs (empathetic)

FEEDBACK TO LEARNERS USING ASSESSMENT TOOLS

We can inspire lifelong learning in our students by helping them to claim ownership of their process and style. Engaging in self-reflection or tracking their own progress on a rubric puts the power to grow and improve in the hands of the student and aids them to uncover the next steps. We suggest a variety of tools that allow students and educators to engage in assessment together. Remember to establish clear and reasonable learning objectives and communicate these to students early on in the process.

- **Rubric:** Rubrics allow for transparency in the assessment process and can be easily adapted for use in a variety of design challenges. Students can both self-assess and receive targeted feedback from the educator.
- **Observation tools:** Checklists support at-a-glance data collection throughout a design challenge, especially during build, test and reflect (prototyping) and sharing out.
- **Peer Feedback Tools:** Established processes for students to provide feedback to each other, such as the Tuning Protocol adapted from Critical Friends.
- **Self-reflection:** Students reflect on their learning, often focused on the design process or on their development of innovator mindsets. Reflection tools also provide an opportunity for students to define their next steps.
  - Reflection tools are in the Innovator Mindsets Tech Tip and can be incorporated in some rubrics.

Resources:

- Sample Rubrics
- Sample Observation Tools
- Peer Feedback Protocol
- Next Generation Science Standards Progression

See our Tech Tips and videos for more information about:

- Innovation Design Process
- Innovator Mindsets
- Computational Thinking