TECH TIP: Data Collection - Reflecting on Your Design

Data collection is a great way to make informed improvements to a design. Data can be quantitative — such as a measurement of distance or time — or qualitative, such as an observation of performance. During testing, teams observe how the design performs and then record measurements, written descriptions of the outcome and new ideas through sketches. At The Tech, we have found that engineers/designers are more engaged in data collection when they help define the criteria and measurements for success and when learners rotate responsibility for data collection. Additionally, adding measurements to design challenges that seem binary (success or failure) can motivate learners with incremental victories and enrich the experience. For example, add an accelerometer to an egg drop activity, or look at the speed of a vehicle rather than just whether it crossed a finish line.

FACILITATION

Novice engineers/designers - provide a data table or other structure for recording their qualitative observations. Discuss with participants why recording data is helpful to them as engineers and how they can use the information in the data table. Relative data may also be useful (e.g. comparing which tower is tallest does not require measurement). Work towards incorporating quantitative data once students are comfortable with the innovation design process.

Experienced engineers/designers - scaffold the participants in creating their own data tables or observation notes using the facilitative questions provided. This can help teams to focus on the criteria and constraints, defining what they will be looking for during testing, and creating a structure to record data and look for patterns.

Collecting Data during Testing

- Have learners test a design multiple times to learn reliability and repeatability as measures of success (i.e., describe components that worked the first time, but failed the next two times).
    - Remind teams that focusing on only one component might not always be helpful when trying to gather information to optimize the design.
    - Tell teams to keep the criteria and constraints for the design in mind as they gather data.
- Strengthen measurement and calculation skills through figuring out differences in results, averages, ratios and rates and looking at the relationships between results and design attributes while analyzing designs (e.g., recording distance travelled and then looking at the wheel-to-axle ratio).
- After building each iteration, learners should describe each iteration in their journal, such as where materials are attached, how materials are used, and the reliability and performance of each iteration, and any other outcomes from testing.

Facilitative Questions Collecting Data

- How will you know if the designs are successful?
- What information might be observed and recorded about each design?
- What will you need to know to help you improve your design?
- What kinds of observations will you make during testing?
- How will you know which design components are connected with successful tests?
- How might we compare our designs to look for patterns?

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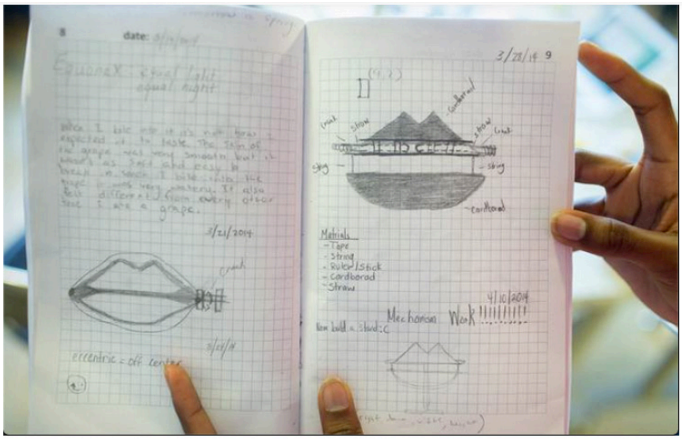
- If sketches, labeled diagrams or journaling were involved throughout the design process, have teams note trade-offs and any design changes between their iterations.



Sharing and Analyzing Data

- Have teams record data on a group data table to promote cross-team collaboration and improvement of everyone's designs. (Data can be recorded in a group Google sheet and projected for the class to show trends in real time.)
- Turn the data table into a graph to visualize trends and compare design strategies.
- Encourage teams to use concepts and specific component names and vocabulary when discussing their designs and recording data rather than "this, that, or thing" (e.g., "This doesn't work when I connect it to this thing" vs. "The axle doesn't rotate when I connect it to the wheel.")
- Encourage students to discuss results and support claims with evidence to inform future designs.
    - Student - "The designs that used a round body shape went faster than square shaped ones." Facilitator - "What data supports this argument?"
    - Student - "When we added an extra fin to our rocket, it traveled two meters farther." Facilitator- "Are there other results that show a correlation between fins and a greater distance traveled?"

Facilitative Questions Analyzing Data

- What are our tests showing us?
- What data supports this argument?
- Did anyone else get a similar result? Different result?
- Did anyone get a result that goes against this argument?
- What trends do we see in the data that can inform our designs (next iteration)?
- What other tests can we do to figure this out?
- What other data can we collect to figure this out?