TECH TALES

MAKE. LEARN. SHARE.

DAY 4: CONSTRUCTION
Design Process

This session engages families in design work, learning how programs can control how electronic devices behave, and the underlying science principles involved in this work. The design work is sometimes open ended play and tinkering and more "how to" tutorials. By the end of the session, families will have most of their sets designed and pieces constructed. Families are integrating lights, motors, and sensors into their designs.

badges

materials

- Light meal
- Projector and slides
- Badges
- Full Hummingbird kits + computers
- Craft materials
- Hummingbird website or troubleshooting guide
- Paper
- Markers/pens
- Storybuilding worksheet in Family Guide

workshop day 4

1. WELCOME & SHARING
Eating a meal together
Sharing any work done from last week

2. STORYTELLING
Share a story, introduce theme

3. EXPLORING
Revisit projects and make a plan for the day
Diorama building
Design/Skill share

4. ACKNOWLEDGING
Reflection on activities + badges
Prepare for next week

EATING & SET-UP

20 minutes

Welcome families as they arrive. Provide food and drinks.

Encourage families to share their progress with other families. Join families at tables and engage them in discussion about their stories, asking questions about what challenges they may be running into and how you might help. Getting to know their hobbies and activities will help you get to know their strengths and any challenges they face outside of your time together.

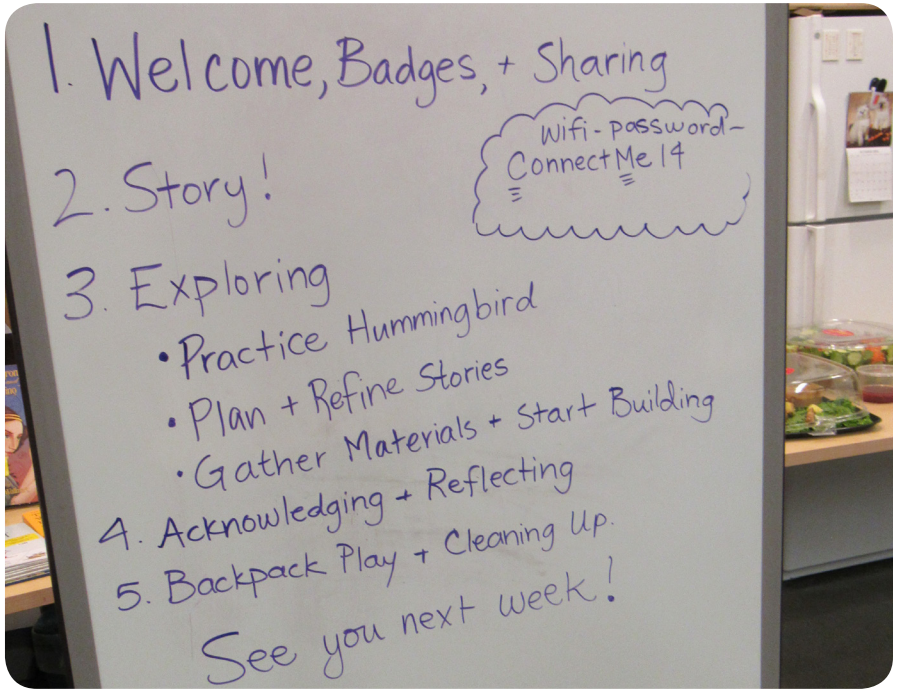
materials

- Meal & Servingware
- Daily Schedule
- Session 4 Slide Deck

set up

Set up food and paper goods on a table. Arrange any books or supplemental items on a table.

Post a schedule of the day prominently in the room, on a white board, paper, or projected on the wall.



STORYTELLING

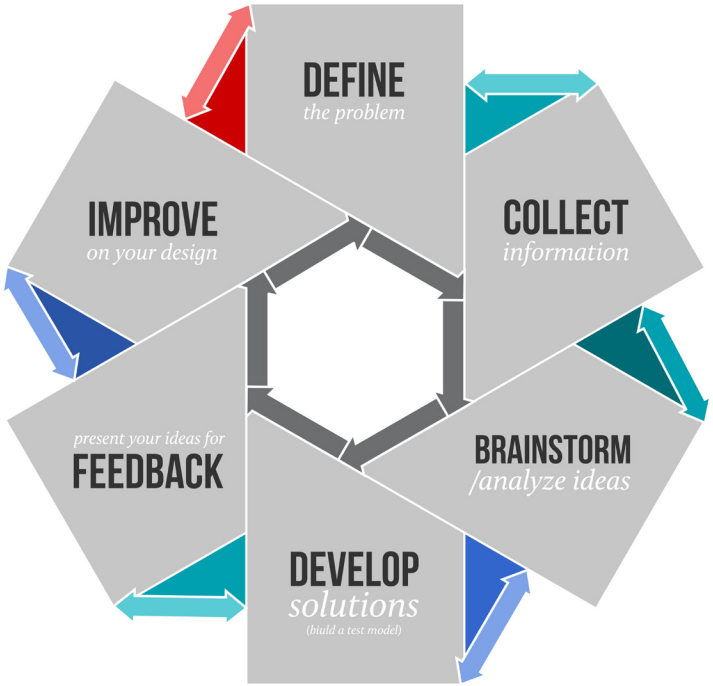
15 minutes

Gather families together. Read a picture book or share a traditional cultural story. If you have the opportunity to invite a visiting storyteller, consider inviting an engineer or other scientist to tell a story from their life.

If the participants are comfortable sharing, offer the option for a participant to share a personal story or read a book.

DAILY THEME

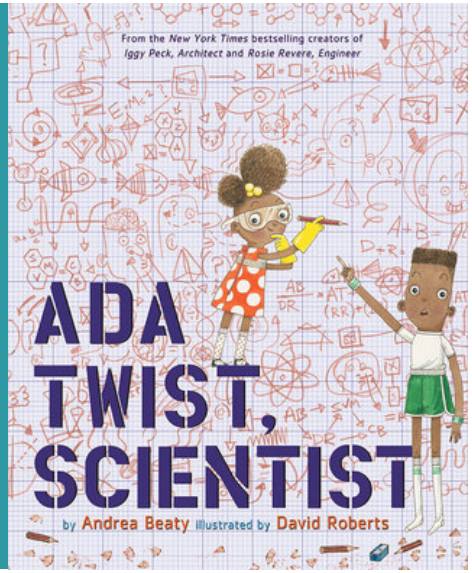
5 minutes



materials

Read-aloud Book or visiting storyteller
Session 4 slides

Suggested book:
Ada Twist, Scientist
by Andrea Beaty,
Illustrated by David Roberts



background info

Stories don't necessarily need to fit in exactly with the day's theme, but themes of problem-solving, growth mindset, design thinking, or perseverance will support the activities.

Have a quick discussion: What is Design?

The **Design Process** is an approach for breaking down a large project into manageable chunks.

Architects, engineers, scientists, artists, and other thinkers use the design process to solve a variety of problems.

Think about how you can plan your design process as you build your diorama.

MAKE A PLAN

15 minutes

Instruct families to turn to the storybuilding pages in their family guide, and to gather all materials they have built for their diorama so far.

EXPLAIN

We are about halfway done with our workshops. Now is the time to reflect on what you've done and see if there is anything that you want to change about your designs.

Their job for the next few minutes is to answer the following questions (have these either projected or on a big poster in the room):

1. Do you want to change something about your design?
2. What do you want to have done by the end of today? (negotiate different/competing ideas/expectations)
3. What do you need to accomplish that? (materials, skills, time)
4. Do you need help figuring something specific out? (building, programming, communicating)
5. Who wants to do which parts? Family members can decide on roles, such as Coder, Connector, Problem Solver, Project Manager.

materials

Tech Tales Diorama Guidelines
Day 4 slides
Storybuilding page in Family Guide
Markers, pencils, pens

Explain the Diorama Guidelines:
Your diorama should have at least:

Hummingbird

ONE INPUT component
(sensor or dial)
TWO OUTPUT components
(lights or motors)

Scratch

ONE EVENT block
(Example: when X clicked)
ONE CONTROL block
(Example: Repeat X times, Repeat forever, Wait X seconds)

Story

A short written paragraph
in your preferred language

background info

Instruct families to think about their role for the day, that is, what they want to be in charge of, what materials they'll need, what they want their robotics to do. Make a plan for what they want to finish by the end of the day.

Remind families:
Projects should be nearing completion by the end of the day

FAMILY DIORAMA BUILDING

60 minutes

At this point, families should be building and rehearsing how the various parts of their projects interact with each other. Facilitators assist as needed, helping with planning, technical help, facilitating conversations. Most work is directed and completed by families.

They should also be writing their paragraph about their story and rehearsing how they want to present their stories.

materials

Computers
Full hummingbird kit and extra components

Craft and building materials

background info

Identity Connection: Explore how technology can support expressions of families' identities and stories.

Potential questions and probes to prompt families: Consider the learning goals with respect to design, force, and energy. Ask families how these target goals are reflected in their project. *For example: How is energy moving in their projects? What kinds of forces are present? How do the electronic components impact force and motion?*

Questions you may ask while you check in with families:

- Are there any problems that you have encountered with your design/programming? How have you tried to solve them?
- What are you most proud of so far in your project?
- Is there some part of robotics/programming that you haven't tried yet but want to try? How can you incorporate that into your project?
- What has been really challenging for you so far? What has been the most fun?
- Why is this story important to your family?

DESIGN PAIR SHARE

20 minutes

Pair up families to talk about their stories and how they designed their projects to bring their stories to life. They may share challenges and how they overcame them. Family pairs will share feedback and suggestions for design solutions.

Group families in either pairs or a group of three (this works best in smaller groups of families, especially if you have larger families). Explain that as engineers design solutions, they share their designs in teams, get feedback, and improve their designs. The purpose of this "design charette" is for everyone to share their current progress on how they are bringing their stories to life, share their challenges/ solutions, and get feedback to improve their designs.

The structure of the task will be as follows:

- The first family shares their story, the scene that they are building, and the parts of their diorama that they have built/ want to build.

Some specific things to share:

- challenges they have encountered (mechanical challenges, challenges in how to translate their story into the robotics parts, assembly challenges, programming challenges, etc)
- strategies for overcoming those challenges
- what they're particularly proud of
- what they still want to do

The second family can ask questions or give feedback, such as: why is this story important to your family? What do you still want to try? What do you like best about your project and why?

materials

- Dioramas in progress
- Storyboarding and story diagramming worksheets

background info

Family members will:

- have opportunities to share stories and project ideas with another family as well as give and receive feedback.
- learn that iteration, challenges, and finding solutions to challenges are part of the engineering process
- deconstruct engineering problems and brainstorm solutions to those problems with other families in order to improve on their designs.

The second family shares their story and the group repeats first and second steps. Plan on about 10 minutes per family.

Family members identify what they want help with, for example: programming a behavior, using a new component, building a certain type of structure, or using a certain tool.

Example: if one family wants to use a gear motor but doesn't know how to program it, have a volunteer from another family join them and show them how to do it.

If a planned task is too complex, suggest breaking it down into smaller parts and tackling one small part at a time. If no one knows the skill requested, facilitators can demonstrate to the whole group or work directly with the family to figure it out.

REFLECTION & BADGES

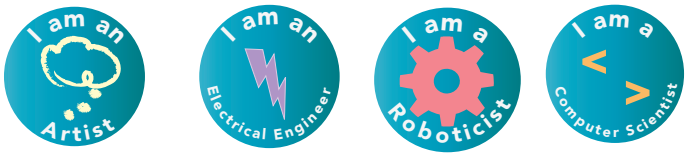
10 minutes

DISCUSSION

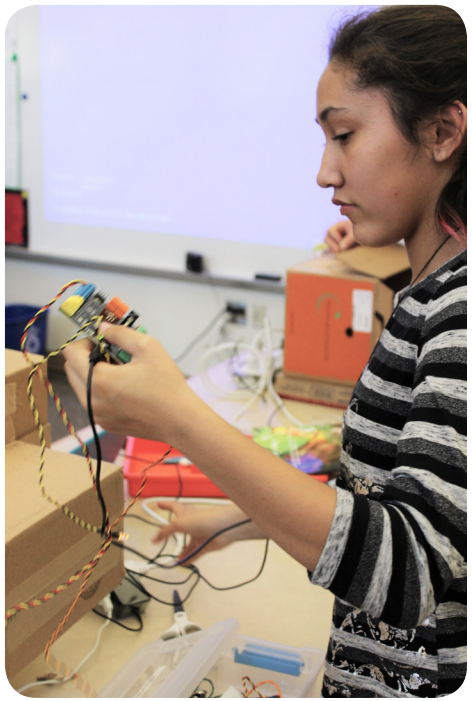
- Debrief the activities that were practiced through the day and relate them to the day's theme. How did today's activities relate to design?
- Issue badges for activities completed during workshop. Explain in today's workshop they used skills from all the roles: electrical engineer, computer scientist, storyteller, and roboticist. However, today they had to bring it all together to make it all work in one final piece. That takes a lot of creativity and problem solving.
- Engineers, computer scientists, designers, and artists use the design process to revise their concept. They test their design, then revise it when they learn new information or techniques. This makes the final product more efficient and robust, or helps them think about how to communicate effectively.

Clean up crafting and robotics materials. If they would like to borrow materials to work at home, let families choose some items to take home. You may want to make a list of tools to keep track of the workshop materials.

badges



If you have a place to store the dioramas until the next session, families may choose to leave them in a safe place through the week. Otherwise, families will take their dioramas home and bring them back next week. They may choose to do more work on them at home.



BADGES

facilitator background

WEEK FOUR: SYSTEMS & TEAMS

The purpose of badges in Session Four is to help illustrate the complexity of coordinating teams (and the skills developed to manage that) and thinking of their story and robotics/etextiles as a system. When issuing badges in Session Four, participants should have a solid idea of the interchangeability of skills across roles. They have discovered that creating and following complex designs is a lot like organizing code. It is not necessary to bridge single actions to roles but best to pull back and reflect on their work as a whole, and what got them to where they are now (and how are they going to finish in time!).

Ask participants...

- What did you learn about yourself?
- What did you learn about your family?
- Who took on which role and why?
- Did you switch roles? Why or why not?
- Can you imagine using things you've learned in the future?
- Do you recognize things you've done in the past that you didn't realize qualifies as computer scientist, electrical engineer, artist?
- These questions should prompt participants to reflect on the work as a whole and hopefully nudge them towards thinking of their skills both reflectively in a new light and forward thinking in potential future circumstances.

MORE RESOURCES

Hummingbird + Scratch programming
https://www.birdbraintechnologies.com/hummingbirdduo/scratch/program/

Failing Forward: Managing Student Frustration During Engineering Design Projects
http://stemteachingtools.org/brief/36