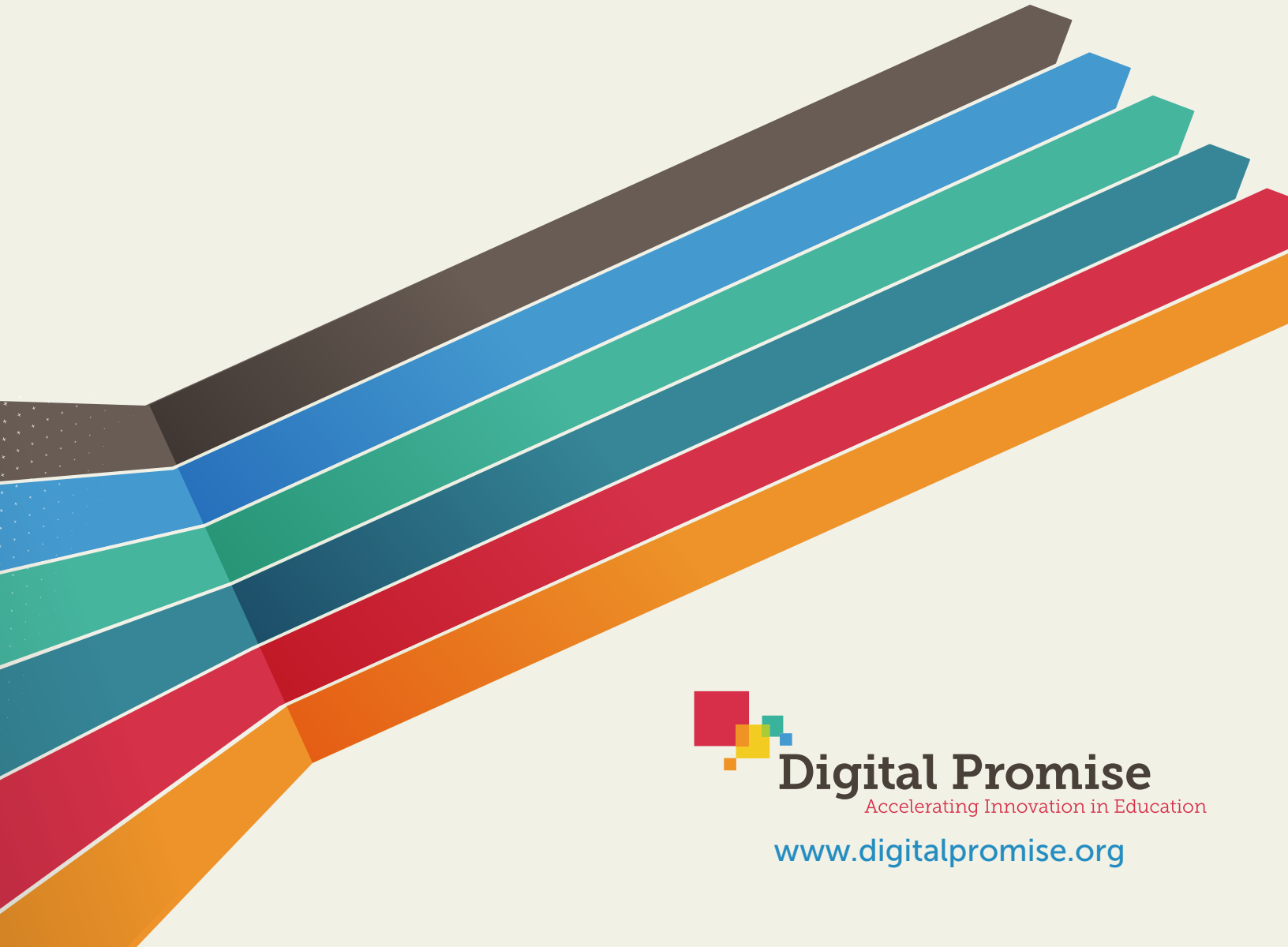
filmMAKER™ Challenge Guide



Digital Promise
Accelerating Innovation in Education

www.digitalpromise.org

Table of Contents

Making Products and Films

This project guide helps students **learn about product design and filmmaking through a set of practice activities, projects, and video challenges**. These experiences culminate in a final project: redesigning an everyday object and creating a documentary video that tells the story of the process.

The Goal

Why does filmMAKER™ pair together product design and filmmaking? Because even the best ideas fail to make an impact if they can't be shared with the world. While working on these projects, students will **design solutions that solve human problems and share their solutions broadly**. In the end, our hope is that students will help real-world audiences recognize their ability to make a difference in the world.

How to get there

These materials are designed to support the development of the following skills and mindsets that will help students' final projects be successful:

- habits of collaboration and iteration,
- familiarity with the design process (empathizing, planning, prototyping, and testing),
- familiarity with fundamentals of visual communication, and
- a sense of "creative confidence" to help students sustain the ups and downs of the ambitious final project.

Try to do at least one of the practice activities, projects, and video challenges in each section; there is no need to do all of the activities or to do them in order. Trust your judgment as a teacher and knowledge of your students to guide you through the selection, implementation, and if necessary, modification of these projects and activities.

There is no one-size-fits-all way to learn and this guide is intended to provide a balance between guidance and flexibility.

How to know you are on the right track

One key indicator of success along the way will be when students no longer need to ask you, as the teacher, "Is this what you wanted?" Instead, students will test their ideas on authentic users and trust the iterative nature of the design process to help them accomplish their goals for each activity.

About this challenge guide

This guide follows the format of Challenge Based Learning (http://bit.ly/DigitalPromiseCBL), a three part process for planning and tackling large challenges with students. In part 1, we ENGAGE to understand the challenge, the big ideas, and essential questions. In part 2, we INVESTIGATE by completing some guiding activities that will help us to understand and learn the skills and knowledge that will allow us to compete the challenge. And finally, in part 3, we ACT by developing, implementing, and evaluating our design.

Engage: Collaborating and Looking Closely

Practice:

Identifying Pools of Knowledge and Expertise

Objectives: build community, establish an atmosphere of collaboration, and identify existing pools of expertise among students

Materials needed:

- Computer/projector to view YouTube video as a group
- Sticky notes
- Pens/pencils

Time: 30-40 mins

Details

- **Watch** "ABC Nightline - IDEO Shopping Cart (http://bit.ly/designashoppingcart)" (~8 mins)

- **Discuss** how IDEO approaches collaboration:
  - What different skills and experiences did members of each team have? Did anything about this surprise you?
  - Different teams came up with different ideas, and eventually the different ideas merged into one final prototype. How did this process work? What do you expect the challenges of this process might be?
  - What can we learn about collaboration from this video? What might we try to emulate in upcoming projects?

- **Identify** existing skills and interests among students with a "gallery walk":
  - **Pose** the following questions for the students to consider silently:
    - What are your interests outside of school?
    - What do you see as your talents/strengths?
    - What are you curious to learn more about?
  - **Ask** the students to write down as many answers to these questions as they would like on sticky notes (one answer per sticky note).
  - **Post** the sticky notes around the room to create a "gallery" of answers. Cluster answers to each question in different areas of the room.

- **Allow** students time to walk around the room, reading the answers of their classmates.
- **Regroup** for a conversation about the strengths and interests they see in the group.
- **Encourage** students to value the diversity of talent in the room as a strength for collaboration.

Teacher Tips

- Some students will have a hard time writing anything down on sticky notes. That's okay! The gallery walk format of this activity is designed not to put any one student on the spot.
- Some students may have experiences that will directly contribute to the final project's goal of redesigning an everyday product; others may think that they do not. The goal of this exercise is to validate the interests and abilities that students bring to the table. In the end, the interests and experiences of the group will determine the direction that the final project takes.

Wrapping Up

Embrace peer learning. It's likely that some students will identify an interest in learning skills that other students identify as areas of strength. As the teacher, your best contribution may be helping students to run their own informal workshops, providing additional meeting time, and providing more access to tools and resources.

Practice:

Building Ideas Through Improv

Adapted from "Improv activities for design thinking (http://bit.ly/dschoolimprov)" by the d.school

Objectives: establish community norms about supportive collaboration, and practice reframing challenges as opportunities

Materials needed: none

Time: 20-30 mins

Details

- **Introduce** the rules of the game:
  - Small groups (2-5 people) will plan an activity (e.g., a vacation, a party)
  - The group will make the plan collectively, with each person contributing only one sentence at a time
- **Play** the game twice:
  - The first round, every time someone proposes an idea, someone else should answer with "Yes, BUT... (reason why that is not going to work)".
  - On the second round, the response should be "Yes, AND... (add something that builds on the first idea)".
- **Debrief** about the group energy and what kind of ideas came out in each round.
- **Play** the game one more time, requiring that every sentence (except the first) begins with "Yes, and...". Challenge students to build on even the most imaginative ideas constructively instead of rejecting them.

Teacher Tips

- Watch Big Think's video (http://bit.ly/valueofdivergentthinking) (~3 mins) for more context on how "Yes, and..." encourages divergent and convergent thinking that is valuable for designers.
- The d.school suggests many improv activities. Feel free to explore other games they list (http://bit.ly/dschoolimprov)!
- Students may need the activity to be modeled or redirected by you. Feel free to jump in!
- Embrace the absurd. Even outlandish ideas can be redirected with a constructive follow-up. Imagine, for example...
  - If a dangerous suggestion comes up: "...Yes, and with that we'll launch fireworks in the playground!"
  - It can be redirected instead of rejected: "Yes, and we'll invite the fire department to be there to make sure that everyone is safe!"
  - And that only keeps the creative thinking and momentum of the activity moving forward: "Yes, and we'll record a video of the fireworks from the top of the fire truck's ladder!" "...Yes, and when that video goes viral online, we'll donate the proceeds from ads back to the fire department!"

Wrapping Up

Play! Enjoy it. A foundation of support, collaboration, and positivity is a great basis to sustain the creative challenges that lie ahead.

Practice:

Connect the Dots

Objective: discuss the challenges of thinking outside the box

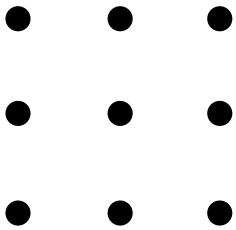
Materials needed:

- pens/pencil
- paper

Time: 10-15 mins

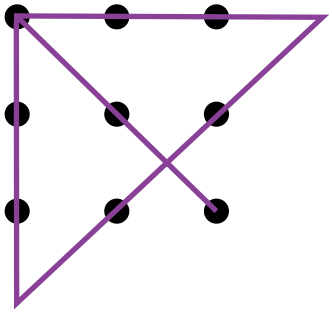
Details

- **Set up the puzzle:** show students a 3x3 grid of dots and ask them to draw the same image on their own piece of paper.



- **Challenge** the students to connect all the dots with 4 continuous straight lines. Allow them a few minutes to work silently.

- **Reveal** how to solve the puzzle:



- **Discuss** how this puzzle was solved:
  - What is the trick to solving this puzzle?
  - Why might it be hard to see this solution right away?
  - What can we learn from this exercise about problem solving and (re-)designing things?

Teacher Tips

- This is the only activity with a "correct" answer; all other challenges in this collection are significantly more open-ended. Be sure to emphasize that the goal of this activity is the discussion that comes afterward — not any individual's ability to "get it" right away.

  To this end, it may be best for the teacher to reveal the answer to the puzzle rather than calling on a student to explain it to the rest of the group.

- Take a look at this video (http://bit.ly/outsidetheboxpuzzle) for an example of the activity.

Wrapping Up

All challenges students take on will face constraints: limited access to tools and materials, limited skills, limited time. Even the particular framing of each challenge is a limitation. Return to this puzzle as an ongoing reminder of the importance of creative thinking to address the problem at hand regardless of limitations.

Project:

Museum of the Mundane

Adapted from Parts, Purposes, Complexities (http://bit.ly/partspurposescomplexities) by Agency by Design

Objectives: stimulate curiosity and examine the complexity of everyday objects

Materials needed:

- used objects (e.g., toys, clocks, dry erase markers, ball point pens, anything with a motor or fan) that can be disassembled
- hand tools (pliers, screwdrivers, etc.)
- art materials to create a display (poster board, tape, markers)

Time: 60 mins

Project Prompt

How might we create a "museum exhibit" that reveals the hidden complexity of everyday objects?

Details

- **Group** students into teams of 3-4, and provide each group with an object. Each group will then...
  - **Investigate** the object by asking following questions:
    - What are the various pieces or components of this object?
    - What are the purposes of each of these parts?
    - How is the object complicated in its parts and purposes, the relationships between the two, or in other ways?
  - **Look closely** to explore each of these questions. Students may disassemble the object in order to look at each part from multiple perspectives.
  - **Display** what you discover on poster board so that others can appreciate the complexities of your object.
- **Invite** friends and peers to visit the museum.

Teacher Tips

- The thrill of disassembling objects can be either a blessing or a curse with this project. The trick is to help students approach disassembly carefully and intentionally: aim to capture students' excitement of discovery and curiosity without allowing them to destroy objects carelessly.
- Encourage students to investigate the three questions in sequence: first the parts, then the purposes of those parts, and finally the complexities that emerge.
- One part may have multiple purposes. Provoke students to question the purpose of every bend, groove, and flange on each component.
- Choosing the right object can make a big difference with this project. Objects that have multiple mechanical parts are typically the most fruitful; objects that rely heavily on electronics are typically circuit boards in plastic enclosures, which are opaque to further examination.
- If it is not possible to invite visitors to view the displays, ask each group to present their object and poster board to the other groups as a culminating activity.

Wrapping Up

Like all projects in this collection, the teacher's satisfaction does not need to be the primary indicator of when a project is complete. Instead, allow the students to assess how successful the project was based on:

- how well they understand the complexities of their objects, and
- how their peers could appreciate the complexities of the objects based on the displays.

Video Challenge:

Graphic Design and Visual Communication

Each video challenge in this guide is related to the project that precedes it. In this case, the project and the video challenge are one and the same.

The presentation of the museum exhibit — a challenge of visual communication — is the first step on the path to creating a 5-minute documentary video following the final project. Be sure that all students share the burden not just of understanding the complexity of their object, but of designing an effective display to convey this complexity.

Goal

How might we create a "museum exhibit" that reveals the hidden complexity of everyday objects? (That's right: this challenge is built into the project!)

Guiding questions

- **Consider the viewer.** How does the display explain the complexity of the object? How could the display be made simpler and more accessible for a first-time viewer to understand?
- **Move beyond lists.** How can you organize your thinking in such a way that clearly displays the complexity of the object? How can size, position, and color communicate significance?
- **Let the display speak for itself.** Does the display require a person to explain the object's complexity to the viewer? Can the display do that effectively on its own?

Technical tips

- Would this work as a billboard? Billboards have a lot to teach us about graphic design: they must communicate their message as clearly and quickly as possible in order to be effective and safe. Ask students to photograph or take note of effective billboards they see and analyze their key characteristics (their parts, purposes and complexities, even) in terms of graphic design.
    - Just make sure the students are not the ones driving when they do this!

Additional challenges

- Practice graphic design skills by creating posters advertising the museum exhibit
- Design a survey sheet for exhibit visitors to complete as they view the displays
- Create a brief stop-motion animation "exploding" the object as a way to advertise each group's display

Investigate: Testing Ideas with Prototypes

Practice:

How to Cheat at (Miniature) Skee Ball

Objectives: practice prototyping and testing designs

Materials needed:

- 3-oz paper cups
- Ping pong balls
- Tape (scotch tape, masking tape, or duct tape)
- Paint stirrers
- Wooden dowels
- Rubber bands
- Corrugated cardboard
- Scissors
- Markers

Time: 30-45 mins

Details

Skee ball is a carnival game in which a player rolls a softball-sized ball up a ramp, aiming to have the ball land in holes at the end of the ramp for specified numbers of points. In this activity, students will create their own tabletop skee ball game, but with a twist.

- **Start** with a short conversation about skee ball: have students played before? Do they have particular techniques for getting high scores?

- **View** a video (http://bit.ly/playingskeeball) of skee ball in action for students who are unfamiliar (optional).

Students will work in small groups of 2-4. Each group will be at their own table, and each group's table will be transformed into its own miniature skee ball game.

- **Create** the targets, or "holes," that you will roll ping pong balls into for points:
  - **Position** 3 paper cups on top of the table, near each other, and a few inches away from the edge. Place them on their side with the mouths of the cups pointing to the middle of the table. (Players will roll ping pong balls into the cups from the opposite side of the table.)
  - **Tape** the paper cups in place.
  - **Label** the cups with numbers to signify how many points each target is worth. (We recommend 1, 2, and 5 points to make one cup a particularly valuable target.)

- **Mark** a starting point a few inches from the opposite end of the table where the shooter must release the ball. (There should be at least two feet between the starting point and cups.)

- **Roll** a ping pong ball from the starting point, aiming for the cups. How many points can you get in 5 attempts?

Already this should feel like a fun game for students to play. Now comes the twist: without moving the cups or the starting point, redesign the rest of the game in order to guarantee a high score!

- Can you create bumpers or a funnel that redirects any errant attempts into the highest-value cup?
- Can you create a launching mechanism that will make a perfect shot every time?
- Can you create a "gutter" that catches any stray balls and redirects them to the targets?

Try to get 5 perfect shots in a row.

Teacher Tips

- Allow students to experiment. This activity is designed to teach students to test their ideas by building and using prototypes — not just to ask the teacher for feedback.
- Who knew that "cheating" could be so much fun? Encourage students to attempt elaborate designs. In the end, skee ball is just a context for their creation; it is okay if the final version of the game does not resemble the original.

Wrapping Up

Depending on how much students enjoy this activity and seem ready to build on it, consider moving directly to Invent A Tabletop game in the next set of projects.

Practice:

DIY stomp rockets

Objectives: practice prototyping and testing designs

Materials needed:

- 8.5x11 paper
- 3x5 index card
- Empty 2-liter plastic soda bottles
- PVC pipe with 1-inch inner diameter (about 12-inches long)
- Flexible vinyl tubing with 1-inch inner diameter (about 3-feet long)
- Scissors
- Scotch tape

Time: 30-45 mins

Details

- **Wrap** a piece of paper loosely around the PVC pipe to create a cylinder. (Don't wrap the paper so tightly that it cannot slide off.)

- **Tape** the seam, then slide the paper off of the PVC pipe. This cylinder will be the central frame of the rocket.

- **Tighten** one end of the cylinder into a pointed tip. You may squeeze, scrunch, cut, twist, and tape the paper to create this pointed tip. (An alternative approach that is both more elegant and more complex: you may also choose to create a pointed cylinder out of a separate piece of paper and tape it to the end of the cylinder.)

- **Test** the rocket:
  - **Connect** one end of the flexible tubing to the 2-liter bottle and the other end to the PVC pipe.
  - **Slide** the paper cylinder onto the open end of the PVC pipe, and point it away from any bystanders.
  - **Stomp** on the 2-liter bottle! The air pressure launch the paper rocket into flight.

- **Iterate:** how can you improve its flight? Consider making a few improvements:
  - Add fins to the base of the rocket by cutting and taping the 3x5 card.
  - Redesign the nose cone (the pointed tip) of the rocket to improve aerodynamics in flight.
  - Measure the height and distance of the rocket to gauge how your changes are affecting the rocket.
  - Create a landing target on the ground and aim for it.

Teacher Tips

- The purpose of this activity is to help students become comfortable building prototypes and testing their ideas. If students struggle to build their first prototype, feel free to help them get started and then emphasize redesigning and rebuilding prototypes that can meet different challenges.
- For additional warm-up activities, consider trying:
  - Marshmallow Challenge (http://bit.ly/trythemarshmallowchallenge) by Tom Wujec.
  - Pop Fly (http://bit.ly/pbspopfly) by PBS Design Squad Global.
  - Rubber Band Car (http://bit.ly/pbsrubberbandcar) by PBS Design Squad Global.

Wrapping Up

When students take ownership of this activity, they may change the parameters of the challenges they would like to tackle. In the end, the particular goals they set for themselves (and accomplish) can vary. What matters most is the habit of keeping the design-and-test feedback loop between themselves and their prototypes.

Project:

Sit on It

Objectives: create a piece of furniture for an everyday purpose, and test it by using it

Materials needed:

- Corrugated cardboard (it's better to have too much than too little)
- Five 6-inch strips of duct tape (per group)
- Utility shears or trauma scissors to cut the cardboard

Time: 45-60 mins

Project prompt

How might we create a functional chair or stool out of cardboard?

Details

Students will work in teams of 4 around a central table of materials.

- **Challenge** each team to create a chair or stool that can sustain the weight of one team member.
  - Note that in order to be considered a chair or stool, the person sitting must be elevated at least 12 inches off the ground
- **Test** your design by sitting on the chair. If it does not work, redesign it!
  - Try bending, folding, or rolling the cardboard to make it stronger
  - Try distributing weight differently
- **Redesign** your chair to improve it:
  - Can you make it more sturdy?
  - Can you make it more comfortable?
  - Can you make it more beautiful?

Teacher Tips

- Cutting a lot of cardboard can be challenging work with scissors. Consider investing in specialized cardboard cutting tools, if possible (utility shears, trauma scissors, power cutting tools [http://bit.ly/cardboardpowercutter], or manual cutting tools [http://bit.ly/cardboardkleverkutter]). These tools are safer, easier to use, and cut more cleanly than regular scissors.
- Limit build time to no more than 15-20 minutes for any prototype. Encourage students to focus on testing quickly and iterating.
- Adjust the amount of duct tape available to each group depending on how much cardboard is available, but be sure to set a limit. Constraints force creativity. This project would be less valuable if students just wrap their entire object in duct tape.
- For options beyond duct tape, consider using zip ties or roofing nails. (Just be safe!)

Wrapping Up

Students who are particularly proud of this project may want to keep the chair in their classroom to use it in an ongoing basis or invite their friends to use it. That's great! Especially in anticipation of the final project, encourage students to make products that have real-world use.

Video Challenge:

Create a Tutorial Video

This video challenge builds on the cardboard furniture students made in *Sit on It*.

Instead of asking the teacher for confirmation or assuming that their ideas work, this set of activities is designed to help students become comfortable using prototypes to validate their ideas. The following video challenge asks students to step back, reflect on their process, and create a 60-second tutorial video that explains how their project works.

Goal

Create a video that explains why you chose to design your chair as you did.

Guiding questions

- **Frame the message.** What should the viewer see during the video: the faces of the designers, the objects, the design process, or some mix? Make a plan before pressing "record."
- **Consider the audio.** Is the sound quality clear? Is the dialogue or voice-over easily understood? Consider writing a script and rehearsing.
- **Videos are prototypes too.** "Test" your video by sharing it with an outside audience and iterate based on their feedback as time permits.

Technical tips

- Use a tripod if possible.
- Video is meant to be shot horizontally (landscape). Don't hold your phone or tablet vertically (portrait).
- Don't film with a bright light source behind your subject (unless you want a silhouette).
- Be intentional about your use of three different shot types. The video will be boring if it only uses medium shots. (see examples on the following page)

Close	Medium	Wide
		
Convey emotion Show detail Draw in the audience	Establish relationships Show action or point of view	Set the scene Display proximity

Table 1:
Types of Camera Shots

Additional challenges

- Create an infomercial to "sell" your chair.

Investigate:
Designing for Users

Practice:

Five Chairs

Adapted from Five Chairs (http://bit.ly/dschool5chairs) by the d.school

Objective: develop confidence designing and iterating solutions for human needs while working with different materials

Materials needed:

- Story cards (http://bit.ly/fivechairsstorycards)
- Sharpies
- Paper
- Scissors
- Corrugated cardboard
- Pipe cleaners
- Modeling clay
- Tape
- Toothpicks

Time: 45-60 mins

Details

First, groups will study their user and describe their design objectives.

- **Gather** students into groups of four, and distribute one story card per group. These story cards describe fictional characters. Each group will develop a solution specifically for the needs of the character on their story card. To do this, groups will take a few minutes to...
  - **Identify** two design principles as rules for building on the needs of their character.
  - **Articulate** their own styles as designers, which they intend to integrate into their prototypes.
  - **Share out** these three key design principles with the other groups.

Next, groups will build 4 iterations of their design. Each prototype should adhere to the stated design principles.

- *Individually:* draw three sketches of your design on a piece of paper.
- *Half of the group:* mold a scale model of your chair using clay.
- *Half of the group:* make a scale model of your chair using toothpicks, pipe cleaners, and tape.

- *Collaboratively:* agree on a design and make a full-size prototype using scissors and cardboard. This prototype should represent the best thinking of the group. Students may use or reuse any materials or ideas from previous prototypes.

Finally, open a group discussion to reflect on the process:

- What was it like to build your chairs using the design principles you identified?
- In what ways was your process different from the cardboard furniture you built in *Sit on It*?
- What was it like to create different iterations of your design?
- What did you change along the way? What did you learn from your prototypes?
- Did anyone get stuck at any point? What was that like? What did you do to get unstuck?
- Which material did you enjoy working with the most? Why?
- Which material did you like the least? Why?
- Which material best expresses the essence of the chair your drew?

Teacher Tips

- Keep the prototypes quick and simple; encourage students not to spend time perfecting them. Prototypes should only exist long enough to test an idea and help you decide how to move forward.
- Emphasize the value of understanding the users' needs and experimenting with ways that different materials can address them.

Wrapping Up

Keep this practice activity quick (no more than 60 minutes), lighthearted, and fun. Don't expect the prototypes to be useful beyond the exercise; instead, keep an eye on how this activity helps students build their creative confidence and a sense of momentum as they prepare for the next set of projects.

Practice:

Giving Gifts

Adapted from The Gift-Giving Project (http://bit.ly/dschoolgiftgiving) by the d.school

Objective: practice iterating through the full design cycle (empathize, define, ideate, prototype, test) while designing a useful, meaningful product for a real-world user

Materials needed: classroom materials

Time: 60-90 mins

Details

In pairs, challenge students to redesign the gift-giving experience for their partners. Be clear about this challenge: the goal is not to design a gift for the partner, but to design something that improves the experience of finding/selecting/buying/giving gifts.

Empathize

- **Interview** your partner about the last time they gave someone a gift. Plan on each person having two turns to interview their partner.
  - Suggestions of what to ask in the first round:
    - How did you select the gift? What was difficult about finding or giving it? Was the gift meaningful?
  - In the second round, try to dig for stories and emotions.
    - How did it feel to see the person receive the gift? What did they say when they unwrapped the gift? Why did you choose to wrap the gift?
  - Encourage students to ask "why?" often. Find out what is important in the experience of giving a gift.

Define:

- **Identify** your partner's goal as a gift-giver. Synthesize your learning into two groups:
  - Your partner's goals and wishes; and
  - Insights you discovered.
- **Write down** a single statement that captures the challenges you are going to address with your design, based on what you have just identified.

Ideate:

- **Sketch** at least 5 different ways to meet your partner's needs.
  - Generate radical ideas; evaluate their viability later.
  - Be visual — don't just write words.

Test:

- **Share** your solutions and capture feedback.

Iterate:

- **Reflect** and generate a new solution.
  - Consider what you learned about your partner and about the solutions you proposed.

Prototype:

- **Make** something that your partner can interact with.

Test:

- **Share** your prototype with your partner.
- **Observe** how they interact and gather feedback.

Gather the group to reflect on their experiences. Discuss the lessons they learned (not necessarily the details of everyone's prototypes).

Teacher Tips

- Refer to the facilitator's guide (http://bit.ly/dschoolgiftgivingguide) for a more detailed script and talking points.
- Have students use the student worksheet (http://bit.ly/dschoolgiftgivingworksheet) to structure the activity.
- Keep time carefully. It's important to set a steady pace so that each group works through the full design cycle.

Wrapping Up

Remember that this is a practice activity. Students will have limited opportunities to iterate and prototypes will be crude. That's okay! Help students work through the design cycle and focus on empathizing with their user.

Project:

Create a Math Manipulative for a Young Student

Objective: design a product to help a real-world user

Materials needed: classroom materials

Time: 2-3 hours

Project prompt

How might we create a tool/product to help young math students learn a new concept?

Details

In this project, small groups (3-4 students) will work through the entire design cycle to create a product for an elementary school student or teacher. Groups need to be able to communicate with these potential users for this project to be viable.

Empathize

- **Discuss with students:** "What did you find to be the most challenging parts of math class in elementary school?" "What made the biggest impact in helping you be and feel successful?"
    - Be specific. Encourage students to think of particular moments — challenging homework assignments, scary tests, uncomfortable moments not keeping up — across each grade. These difficult experiences can be reframed as design opportunities.
    - Don't focus only on the negative. Augmenting strengths can be just as helpful as addressing weaknesses. Designing ways to enrich positive experiences can help young students' motivation as they face their own challenges.
- **Interview** elementary school students and teachers about their experiences in math.
    - Ask open-ended questions. Follow-up to ask for specifics. Don't just gather information: *empathize* with the experiences of the people you interview.
    - Even if students conduct many interviews, encourage them to keep one specific person in mind throughout this project and to design a solution to help that one particular user.

Define:

- **Articulate**, in one sentence, the users' need that this project will address.
- **Break it down** into discrete steps if students need help agreeing:
    - At the top of a blank piece of paper, each student writes their own sentence framing the

fundamental users' need as a question: "How might we... [make counting numbers on a number line fun for first grade students]?"

  - Students step away from their paper and read what the other members of their group wrote. Allow a few minutes to read and to think.
  - Ask students to return to their piece of paper, and write a modified "How might we..." question at the bottom of the piece of paper based on the questions of their peers.
  - At this point, the students' ideas may be converging enough that they can write a clear and specific challenge they will address.
  - If not, ask students to write notes in the middle of the page that describe the difference between the questions they wrote above and below. Start a dialogue among the students based on these notes until they can converge to a single "How might we..." question.

- **Write** down the final "How might we..." question once the group has agreed on a definition. Keep this question visible throughout the rest of the project.

Ideate:

- **Brainstorm** ways to address this need.
  - Encourage radical thinking! The *Define* step is about convergence; *Ideating* is about divergence.
  - Not all solutions will be physical: some ideas may involve designing systems, software, performances, games, etc.
  - Try having a brain race: challenge students to list as many ideas as they can in exactly 2 minutes, then share their top 3 most promising/interesting/exciting ideas for discussion.
  - Help students think in different modalities: think silently; talk in pairs; write notes; sketch pictures. Structure these different approaches (e.g., a "round robin" of each activity for 60 seconds at a time) while keeping up the momentum and enthusiasm of the group.

Prototype:

- **Build** representative models of 2-3 of the ideas that emerged.
  - Allow students to pursue the ideas before converging on a single concept for the group.
  - Use any materials that are available. The goal of the prototype here is to communicate the idea to other group members — not to have a functioning product.

- **Focus** on the most promising prototype of this batch and refine it.
  - Now it is time to work toward convergence. Have students share their representative models with each other, and ask each group to agree on the best way forward.
    - Remember the one particular user they interviewed during the Empathize stage: the goal is to build a solution that helps this person, not to "win" by having the "best" idea!

- Embrace constraints: this project will happen with limited time and materials. Pursue the idea that can realistically be completed and help the user.
- Encourage students to delegate roles and responsibilities so that everyone can contribute.

Test:

- **Observe** your target user (elementary school student or teacher) using your product.
  - *Define* articulates a question; *ideate* lists possibilities; *prototype* proposes one potential answer. This *test* will give you feedback about the particular answer you provided.
  - Did the prototype validate your answer? What weaknesses can you address in the next iteration?
  - Try not to interfere with the test. The prototype should stand on its own.
  - Consider asking your user for permission to record video of them so that you can analyze how they interact with your prototype later.

Reflect on what worked effectively and what needs to be improved, and then iterate! Given the short timeline of this project, try to keep adjustments between iterations somewhat limited. (For example, refocus your efforts on a particular user need; don't redefine the project for an entirely new user.)

Teacher Tips

- When ideating, draw from the students' experiences in earlier activities: rely on "yes, and...", think outside the box, and allow students to write their ideas before talking to make sure that every student's voice is heard.
- If you do not have time for more than one or two iterations, describe what you would do in a subsequent iteration.

Wrapping Up

An indicator of success with this project is that students are committing to solving the problem, not just building one potential solution and moving on. Their objective should be to create a product that will actually be used in the classroom — both with the students in their test group and beyond.

Based on student interest, this may be a natural transition into the final project.

Project:

Invent a Tabletop Game

Objective: design a tabletop game that their friends like to play

Materials needed: classroom materials (dependent on students' designs)

Time: 2+ hours

Project prompt

How might we invent a new tabletop game that our peers will enjoy playing?

Details

In this project, small groups (3-4 students) will work through the entire design cycle to create a tabletop game (e.g., a board game, a card game, tabletop football, mini skeeball from the practice activity above).

Empathize

- **Discuss** with students: "What are examples of successful and unsuccessful tabletop games? What makes a tabletop game fun? What do you like or dislike about playing tabletop games?"
  - Be specific. Encourage students to think of elements of different games — collaborative vs. competitive games, card games vs. board games, etc. — that they have played.
  - Consider both positive and negative aspects of gameplay. What ideas might you borrow in your own design? What elements will you avoid?
- **Interview** friends and family members about their experiences playing tabletop games.
  - Ask open-ended questions. Follow-up to ask for specifics. Don't just gather information: empathize with the experiences of the people you interview.
  - Even if students conduct many interviews, encourage them to keep one specific person in mind throughout this project and to design a game that would delight that one particular user.

Define:

- **Articulate**, in one sentence, the design principles the group will pursue.
- **Break it down** into discrete steps if students need help agreeing:
  - At the top of a blank piece of paper, each student writes their own sentence framing the design goals as a question: "How might we... [create a collaborative board game that will not take longer than 20 minutes to play]?"

- Ask students to step away from their paper and read what the other members of their group wrote. Allow a few minutes to read and to think.
- Ask students to return to their piece of paper, and write another "How might we..." question at the bottom of the piece of paper that has been modified based on the questions that their peers wrote.
- At this point, the students' ideas may be converging enough that they can write a clear and specific challenge they will address.
- If not, ask students to write notes in the middle of the page that describe the difference between the questions they wrote above and below. Start a dialogue among the students based on these notes until they can converge to a single "How might we..." question.
- Allow students to reformulate groups based on their interests if they wish.

- **Write** down the final "How might we..." question once the group has agreed on a definition. Keep this question visible throughout the rest of the project.

Ideate:

- **Brainstorm** ways to address the design goals.
  - Encourage radical thinking! The *Define* step is about convergence; *Ideating* is about divergence.
  - Try having a brain race: challenge students to list as many ideas as they can in exactly 2 minutes, then share their top 3 most promising/interesting/exciting ideas for discussion.
  - Help students think in different modalities: think silently; talk in pairs; write notes; sketch pictures. Structure these different approaches (e.g., a "round robin" of each activity for 60 seconds at a time) while keeping up the momentum and enthusiasm of the group.

Prototype:

- **Build** representative models of 2-3 of the ideas that emerged.
  - Allow students to pursue the ideas before converging on a single concept for the group.
  - Use any materials that are available. The goal of the model here is to communicate the idea to other group members and demonstrate how gameplay would work — not to have a functioning product.

- **Focus** on the most promising prototype of this batch and refine it.
  - Now it is time to work toward convergence. Have students demonstrate their representative models to each other, and ask each group to agree on the best way forward.
    - Remember that the goal is to build a fun, playable game, not to "win" by having the "best" idea!
    - Embrace constraints: this project will happen with limited time and materials. Pursue

the idea that can realistically be completed.

- Encourage students to delegate roles and responsibilities so that everyone can contribute.

Test:

- **Observe** your target user(s) playing your game.
  - *Define* articulates a question; *ideate* lists possibilities; *prototype* proposes one potential answer. This *test* will give you feedback about the particular answer you provided.
  - Did the prototype validate your answer? What weaknesses can you address in the next iteration?
  - Try not to interfere with the test. The prototype should stand on its own.
  - Consider asking your user for permission to record video of them so that you can analyze how they interact with your prototype later.

Reflect on what worked effectively and what needs to be improved, and then iterate! Given the short timeline of this project, try to keep adjustments between iterations somewhat limited. (For example, refocus your efforts on a particular user need; don't redefine the project for an entirely new user.)

Teacher Tips

- Help students keep each iteration loop as short as possible. While students may want to indulge in any one step for too long, the greatest improvements will come when moving from one iteration loop to the next.
- If students are having a hard time getting started with this activity, consider guiding them through Find Play in Things (http://bit.ly/findplayinthings) by The Institute of Play.

Wrapping Up

There are many meaningful ways to extend this project: designing a box/packaging for the game; creating a rule book; starting a YouTube channel of tips on how to play; etc.

Encourage students to share this project and play during recess and free time!

Project:

Recycling Challenge

Adapted from The Compost Challenge (http://bit.ly/dschoolcompostchallenge) by the d.school

Objective: design a system with accompanying materials to encourage certain behaviors

Materials needed: classroom materials

Time: 2+ hours

Project prompt

How might we influence the behavior of our peers to recycle more?

Details

In this project, small groups (3-4 students) will work through the entire design cycle to create a system that changes their peers' behaviors to recycle (or compost) more frequently.

Empathize

- **Discuss** with students: "When do your peers recycle? When do they not recycle? What makes the difference?" "In what ways does your school encourage recycling? In what ways is recycling challenging or inconvenient?"
  - Be specific. Focus on a particular place — a classroom, the lunchroom — and the patterns they see there.
  - Consider both positive and negative behaviors. Solutions may arise from decreasing negative behaviors or increasing positive behaviors.
- **Interview** peers to understand their habits and behaviors with recycling.
  - Ask open-ended questions. Follow-up to ask for specifics. Don't just gather information: *empathize* with the experiences of the people you interview.
  - Even if students conduct many interviews, encourage them to keep one specific person in mind throughout this project and to design a solution to help that one particular user.

Define:

- **Articulate**, in one sentence, a specific, measurable change you aim to make during this project (e.g. increasing students in a particular classroom to recycle waste paper as measured in pounds or boxes)
- **Break it down** into discrete steps if students need help agreeing:
  - At the top of a blank piece of paper, each student writes their own sentence framing the

fundamental users' needs as a question: "How might we... [make recycling such a common part of our classroom that students remind each other not to throw away paper]?"

- Students step away from their paper and read what the other members of their group wrote. Allow a few minutes to read and to think.
- Ask students to return to their piece of paper, and write a modified "How might we..." question at the bottom of the piece of paper based on the questions of their peers.
- At this point, the students' ideas may be converging enough that they can write a clear and specific challenge they will address.
- If not, ask students to write notes in the middle of the page that describe the difference between the questions they wrote above and below. Start a dialogue among the students based on these notes until they can converge to a single "How might we..." question.

- **Write** down the final "How might we..." question once the group has agreed on a definition. Keep this question visible throughout the rest of the project.

Ideate:

- **Brainstorm** ways to address this need..
  - Encourage radical thinking! The *Define* step is about convergence; *Ideating* is about divergence.
  - Most solutions will be systems, which may have some physical components and some digital components.
  - Try having a brain race: challenge students to list as many ideas as they can in exactly 2 minutes, then share their top 3 most promising/interesting/exciting ideas for discussion.
  - Help students think in different modalities: think silently; talk in pairs; write notes; sketch pictures. Structure these different approaches (e.g., a "round robin" of each activity for 60 seconds at a time) while keeping up the momentum and enthusiasm of the group.

Prototype:

- **Build** representative models of 2-3 of the ideas that emerged.
  - Allow students to pursue the ideas before converging on a single concept for the group.
  - Use any materials that are available. The goal of the prototype here is to show — and not just tell — other group members about the concept.

- **Focus** on the most promising prototype of this batch and refine it.
  - Now it is time to work toward convergence. Have students share their representative models with each other, and ask each group to agree on the best way forward.
    - Remember the one particular user they interviewed during the *Empathize* stage: the goal is to build a solution that helps this person, not to "win" by having the "best" idea!
    - Embrace constraints: this project will happen with limited time and materials. Pursue the idea that can realistically be completed and help the user.

- Encourage students to delegate roles and responsibilities so that everyone can contribute.

Test:

- **Observe** your target audience's recycling behavior.
  - *Define* articulates a question; *ideate* lists possibilities; *prototype* proposes one potential answer. This *test* will give you feedback about the particular answer you provided.
  - Did the prototype validate your answer? What weaknesses can you address in the next iteration?
  - Try not to interfere with the test. The prototype should stand on its own.
  - Consider measuring recycling the recycling bins at regular intervals to understand behavior over time.

Reflect on what worked effectively and what needs to be improved, and then iterate! Given the short timeline of this project, try to keep adjustments between iterations somewhat limited. (For example, refocus your efforts on a particular user need; don't redefine the project for an entirely new user.)

Teacher Tips

- Encourage students to keep a tight focus on one specific location and audience.
- The only way to know when the solution is "working" depends on the users' recycling behavior. This project may need to be distributed over time to assess the effectiveness of the design.
- Help students keep each iteration loop as short as possible. While students may want to indulge in any one step for too long, the greatest improvements will come when moving from one iteration loop to the next.

Wrapping Up

Changing behavior is hard! Keep an eye on students' momentum as they wrap up this project, and consider focusing on frustration points in this project as the starting point of the final project.

Video Challenge:

Record User Testimonials

This set of activities is about human-centered design. In the end, students should care about making solutions that satisfy the needs of real users — not just making things that vaguely "work." The following video challenge asks students to spend more time with their users in an interview setting.

Goal

Interview at least two people who used your project and create a video that shows them using and talking about the solution that you created for them.

Guiding questions

- **Picture it.** What is the image you want viewers to see? How can you frame the interview and any additional footage of your solution (both at rest and in action) to communicate this?
- **Introduce it.** Your solution addressed some sort of problem. How can your video explain the problem that is addressed and not just the solution?
- **Edit the video.** How concisely can you convey the user's message? Can you integrate footage of the user interacting with the prototype as they describe their experience?

Technical tips

- 95% of your footage belongs on the cutting room floor. (20 min. footage for 1 min. video)
- If it doesn't advance the story, cut it.
- To make a great nonfiction video, approach it as a narrative in three parts:
  - The hook: why is this subject important or interesting? Make the viewer care.
  - The turn: something exciting happens. Explain it to the viewer visually.
  - The release: therefore, a situation is resolved. Provide closure.

Additional challenges

- Create a "pitch video" in the style of videos on Kickstarter, which would explain the effectiveness of your solution and enlist people's support in helping it reach a broader audience.
- Create a highlight reel of people interacting with your project.

Act:
Make a Product.
Make a Film.

Project:

Reinvent an Everyday Product

Objective: redesign a real product for real users

Materials needed: dependent on students' goals

Time: 4-12 hours

Project prompt

How might we reinvent an everyday product to make it more sustainable, accessible, or beautiful?

Details

Help small groups of students through the design cycle as they work on their final project. Encourage students to apply what they have learned throughout this entire process. Don't be afraid to think outside the box when it comes to the design process itself: expect to iterate frequently, and not just at the "end" of the cycle!

Empathize:

- **Discuss** our own experiences:
  - What items/products/tools do you use every day?
  - What frustrates you about these items?
  - Does everyone have access to use these items?
  - Do people want to use these items?
- **Interview** friends and family.
- **Observe** how other people interact with everyday products.
- **Apply** what you learned from previous projects: make sure to be specific, and focus on the positive, not just the negative.

Define:

- **Identify** one specific need and articulate a clear design goal.
  - **Use** strategies from previous projects to converge on a single design goal.
  - **Display** this design goal prominently for the remainder of the project. All brainstorming,

prototyping, and testing will aim to respond to this goal.

Ideate:

- **Brainstorm** radical ways to address this need.
  - **Remember** to work in different modalities; try a gallery walk; play "Yes, and..."; have a brain race.

Prototype:

- **Build** multiple representative models of the ideas that came up.
  - **Communicate** your ideas through materials; this will allow you to begin to converge without agreeing on a single concept yet.
- **Focus** on the most promising idea and refine it.
  - **Create** a solution that you can test as quickly as possible. The goal is not to create a perfect product on the first time; it is to create something that you can test on real users to improve on the next iteration.

Test:

- **Observe** real users interacting with your prototype.
- **Reflect** on what worked and what did not.

Iterate!

Depending on the frequency and length of your classes or meetings, it may take as long as 3-4 weeks to deliver a polished final product. Students have developed the skills they need during previous projects to pursue this one; your role now is to be "project manager" as much as "teacher." Draw from experiences with previous projects; push through the design cycle to test and iterate frequently; and focus on keeping up the students' sense of momentum.

It may help to ask students to devise their own project timeline so that they have concrete goals and so that they will plan to iterate their solution multiple times. Post the timeline somewhere visible (perhaps adjacent to the design goal from the *Define* step) throughout the project and update it when needed.

For example:

Week 1:

- *Empathize* with your users: discuss the prompt with your group; interview real world users; debrief on interviews to assess user needs.
- *Define* a clear design goal.

Week 2:

- *Ideate* potential solutions.
- *Iterate* if needed: "Do these ideas address the real needs we learned while *empathizing* with our users?" Return to *Define* if needed.
- *Prototype* representative models of a ideas.
- *Iterate* if possible: interview users again to ask questions that will help you refine your prototype.
- *Prototype* a more polished version of your product.

Week 3:

- *Test* your prototype with users.
- *Iterate:* in what ways can this prototype be improved to better achieve the design goal? Do we need to *redefine* the design goal before creating another prototype? Did we misunderstand something fundamentally important about our users when *empathizing*?
- *Prototype:* refine your product.

Week 4:

- *Test* and *iterate* as time allows.

Teacher Tips

- This is an ambitious, long-term project. Keep an eye on the momentum of the group, and push them through iteration loops as quickly as possible.
- Encourage students to take on different responsibilities. Allow students to work on documenting the process as filmmakers while others work through the design process.
- Students will (hopefully) become deeply invested in their own group's work. Establish semi-regular discussions among all of the groups to help maintain enthusiasm and support among all students.
- Read about 6 challenging, inspiring redesign concepts in the New York Times (http://bit.ly/nytredesignconcepts) for examples of how professional designers approach this sort of project.

Wrapping Up

When will this project be finished? Maybe never; maybe when students use their product on a daily basis; maybe when their product is on the shelf at a local store. Shoot for the stars!

Video Challenge:
3-5 minute Documentary Video

Throughout the entire final challenge, students will be recording footage of their own process to create a 3-5 minute video that captures their process as designers, makers, and problem solvers.

As you are able, guide students through the following exercises to help structure the work of creating the final video.

- **Finish this sentence:** I want this documentary video to tell a story about...
  - e.g., how we work together, the specific problems we are solving, our creativity, etc
- **Picture your audience** in your mind. Don't think of a faceless group of people; think of someone specific who will represent the larger audience you want to reach.
- **Create a concept map** of all of the elements that come to mind when thinking of this topic.
  - Click here for an example (http://bit.ly/videoconceptmap).
- **Complete the following sentences** while keeping the concept map in mind:
  - During this video I want the audience to **see...**
  - During this video I want the audience to **hear...**
  - During this video I want the audience to **feel...**
  - Describe the **world** you want the audience to inhabit during this video:
  - After watching the video I want the audience to **feel...**
  - After watching the video I want the audience to **take action** by...
- **Decide on a focal point** of the story: who/what are we watching, learning from, or emotionally connected to throughout this story?
- **Create a "logline"** for the story: a 1-3 sentence snapshot that captures who/what/how/where/why of the video.
- **Create an outline** of the entire video.
  - Like all stories, the video should have a beginning, a middle, and an end.
  - Consider making a storyboard: sketching key moments and scenes in the video so that you envision them before you attempt to record them.
- **Draw from what you learned** in the first three video challenges. You have already learned a lot! Once you envision the first image you want the audience to see, you will be well on your way to creating a great documentary video.

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