



The ICT4me Curriculum

About ICT4me

ICT4me is an after school and summer curriculum for middle school youth to develop ICT fluency, interest in mathematics, and knowledge of information, communication, and technology (ICT) careers. This problem-based curriculum capitalizes on youth interest in design and communication technologies. ICT4me provides structured interactions with ICT professionals, including having youth participate in engineering design and development teams. ICT4me's promotes a train-the-trainer approach to building capacity in informal ICT learning.

Build IT vs. ICT4me

ICT4me is a derivative of the Build IT curriculum co-developed between SRI International and Girls Inc. of Alameda County. Questions about the Girls Inc. implementation of Build IT can be directed to them at <http://www.girlsinc-alameda.org/about/contact>.

SRI is no longer supporting the development of ICT4me, so the curriculum materials are offered as is.

Copyright

Copyright © 2016 by SRI International. All rights reserved.

Attribution

This material is based upon work supported by the National Science Foundation under Grant Nos. 1339181, 1232461, and 0524762. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Electronic Versions of Materials

Electronic versions of all materials in this unit are available for download from the website at <http://ict4me.sri.com/>.

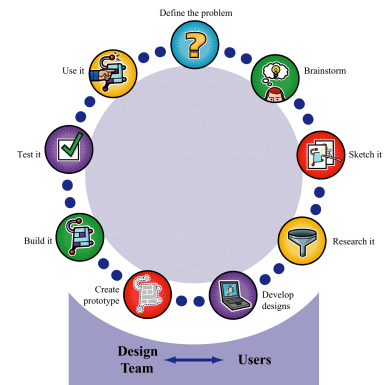
Contact Information

Please contact the SRI International Inquiry line for questions about ICT4me.
<https://www.sri.com/contact/form>

Unit 1: Redesigning Your World

Overview

In this introductory unit for ICT4me, youth explore the designed world through hands-on activities while learning that design is a process that involves identifying and solving problems for a specific group of users. They learn to analyze familiar objects as designed objects with affordances and limitations. Youth learn about the Design Process—a process that they will use throughout ICT4me.



Enduring Understandings

Why does design matter beyond this unit? These enduring understandings help answer that question and give focus to the activities in this unit, they are the big take aways.

- Design is a process that involves identifying and solving problems for a specific group of users. All of the objects, tools, technologies, places, transportation systems, buildings, and media—the human construction of the world—that we encounter every day went through and may continue to go through the Design Process.
- The Design Process, composed of specific stages and elements, is a sequence of strategies for addressing user needs and satisfying constraints: brainstorming, planning, gathering user data, scenario development, storyboarding, requirements and documentation, prototyping, user testing, and revising.
- Design is iterative. An initial solution is often revised or improved by iteration, which often causes a refinement in the definition of the problem.
- A “mathematical disposition” toward problem solving requires analyzing given information, drawing on specific strategies, and having the ability to monitor and adjust strategy use.

Essential Questions

Essential questions guide the activities for a day or session.

- Where do you see design around you?
- What is the Design Process?

Unit Layout

Unit 1 is designed for two 70-minute sessions per week over 10 weeks. This document includes weekly leader preparation and curriculum sections.

The Summary and Getting Ready prepare leaders for each week's activities. The *Summary* section includes the Schedule and Goals, Essential Questions, Design Process concepts, Glossary definitions, and a list of all the Materials needed for the activities that week. The *Getting Ready* section includes an Overview of the week's activities and Background information on the topics covered in the activities for the leader. For some weeks, we provide additional readings or websites in case leaders want to Learn more.

Each week has four activities: Warm-Up, Challenge, Main Activity, and Discussion/Reflection curricular sections. Generally, the Warm-Up and Challenge take place during the first 70-minute session. The Main Activity and Reflection/Discussion take place during a second 70-minute session. Activity Pages include the handouts needed for the week.

Thoughts on Gender

Design is all around us, done by adults and youth. ICT4me units are designed to engage all youth in learning about design and Computer Science. It was especially designed for getting girls, African-American and Latino/a youth hands on opportunities to learn and develop expertise in these fields.

All youth should have an opportunity to explore the materials without being deterred by their own or others preconceptions about gender and race, in safe environments that promote collaboration, learning, and self-expression. All youth should have the same opportunity to see themselves reflected in the ICT professionals with whom they interact.

Gender Tips appear in orange boxes throughout the curriculum, with ideas on how to address particularly sticky topics.



Gender Tips

Connecting gender to ability (or lack of) or way someone or something looks or behaves is a slur. Just like a racial slur. Explain to youth that slurs (racial, gender, sexual orientation, age, etc.) are not cool and not welcome.

Table of Contents

Week 1: Your Designed World.....	5
Summary	5
Getting Ready	6
Warm-Up	9
Challenge.....	10
Main Activity.....	11
Discussion/Reflection	12
Week 2: What Type of Shoes?.....	13
Summary	13
Getting Ready	14
Warm-Up	17
Challenge.....	19
Main Activity.....	21
Discussion/Reflection	22
Week 3: Gizmos, Gadgets & Dream Machines.....	23
Summary	23
Getting Ready	24
Warm-Up	26
Challenge.....	27
Main Activity.....	29
Discussion/Reflection	30
Week 4: Things That Fly.....	31
Summary	31
Getting Ready	32
Warm-Up	35
Challenge.....	36
Main Activity.....	40
Discussion/Reflection	41
Week 5: The Perfect Hangout: Interacting with Users	42
Summary	42
Getting Ready	43
Warm-Up	45
Challenge.....	46

Main Activity.....	47
Discussion/Reflection	48
Week 6: The Perfect Hangout: The Design Process	49
Summary	49
Getting Ready	50
Warm-Up	51
Challenge.....	52
Main Activity.....	53
Discussion/Reflection	54
Week 7: The Perfect Hangout: New Users' Need.....	55
Summary	55
Getting Ready.....	56
Warm-Up	57
Challenge.....	58
Main Activity.....	59
Discussion/Reflection	60
Week 8: The Perfect Hangout: Performance Task.....	61
Summary	61
Getting Ready.....	62
Warm-Up	63
Challenge.....	64
Main Activity.....	65
Discussion/Reflection	66
Weeks 9 & 10: Family Tech Night (FTN)	67
Summary	67
Getting Ready.....	68
Warm-Up: Brainstorming a Plan for FTN.....	70
Main Activity: Creating a Plan for FTN.....	71
Discussion/Reflection	72
FTN Presentations	73
Activity Pages	74

Week 1: Your Designed World

Summary

Schedule

Warm-Up	Identify design in your life.	15 min
Challenge	Develop a 3-D design.	55 min
Main Activity	Create a design collage.	55 min
Discussion/Reflection	Introduce ICT4me	15 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- All

Materials

- Design Process poster
- *Design Notebooks*
- Poster or butcher-block paper
- Blackboard
- Whiteboard
- All sorts of building and design materials that girls can use
- Flip chart
- Overhead projector
- Glue
- Scissors
- Pens and markers
- Magazines with a variety of designed products, including: buildings, technology, toys, etc.

Getting Ready

Overview

The first sessions in Unit 1 will introduce youth to the ideas that:

- Many of the objects, places, and tools we use every day are designed.
- People are the designers of the things that we use. These designers can influence the world around them through their designs.
- Designers use the Design Process as a tool in their work.
- Design is iterative. Designers go back and redesign their work continually.

Glossary

The glossary includes words that may be new to you and to the youth. It's important to use these words with the youth in context and to encourage them to use the words too. The goal is for youth to be familiar with the words, not to memorize them or focus on the definitions. You may be tempted to do vocabulary games. Resist the temptation! Instead, think of fun ways to integrate the words into the activities where youth are designing and creating.

- **Design.** A process that involves developing a plan for a product or system to address a specific group of users' needs.
- **Design Notebook.** A tool to capture ideas, sketches, and other information for designs.
- **Design process.** A sequence or order of strategies for addressing user needs and satisfying design constraints. Designers from different disciplines (e.g., architecture versus software design) will have somewhat different approaches. A general Design Process sequence includes defining the problem, which includes defining who the user is; brainstorming; sketching; researching; developing designs; creating a prototype; building it; testing it; and using it. Once users use it for a while, refinements and new design ideas occur to the designer.
- **Designer.** A person who designs any of a variety of things.
- **Invention.** A novel device, material, or technique that has been designed. An invention is a design, but a design isn't necessarily an invention.
- **Iterate (also iterative, iteration).** To say or do something repeatedly to make something better. In the Design Process, you get feedback on your design from users so that you improve your design.
- **User.** Users are the people for whom a product is designed.
- **Form.** What a design looks like, including the size, shape, color, texture, material, and features of an object.
- **Function.** What a user can do with a designed object.

Background

Design is a process that can take many forms, depending on the product being designed and the individual or individuals participating.

- *Design* as a verb means to generate ideas and develop a plan for the form and function of a product.
- *Design* as a noun means either the final plan for creating an object (a drawing, model, or other description) or the actual product produced.
- A design can be an invention. An invention is a novel device, material, or technique. For example, the Internet is both something that was invented and something that is designed; but not all designs are inventions—you can restyle a coffee mug without inventing mugs.

Design is all around you. Designs include both *function* (what a product is designed to do) and *form* (how a product is designed to perform its specific function).

While the intended function of a designed product remains the same, the form may vary. For example, while soda bottles used to be made of glass, they are now made of plastic and come in various shapes and sizes. The function of the bottle is still to hold a drink, but the form has changed to serve the function better—now we don't have to worry that the bottle will break.

What is a designer? A designer is a person who decides what something does (function) and what it looks like (form). Designers are creative people who often draw or use visual representations to organize their work. Examples of designers include architect, costume designer, engineer, graphic designer, industrial designer, landscape designer, and web developer.

What do designers do? Designers create products that satisfy the needs of their users. Users are the people for whom a product is designed. Designers have to think about what their users need, unlike artists, who have the freedom to create things without consideration for users. For example, rock musicians can sing or play about whatever they want, while someone who designs advertising jingles has to consider how best to sell a product.

The Design Process. The Design Process is an iterative process (create, get feedback, revise, get feedback, revise, etc.) in which designers generate ideas and use information and feedback from users (consumers) to create real products. Designers have a slightly different version of the Design Process, based on their particular field.

Things to Do Before the Unit Starts

1. **Enlarge and laminate the Design Process graphic so you can use it as a poster. Refer to the Design Process poster in every session of Unit 1.** Have youth point out on the poster what design steps they did in a session. As the youth become more familiar with the Design Process, encourage them to use an erasable marker to draw the connections

that they see among the steps in the process. As a large group, discuss these connections.

2. Incorporate glossary words into project work, discussions, and reflection time with the youth. These are words they should learn to use, not just memorize the definitions.
3. Find out if there is a design competition in your area. You can adapt the curriculum by using the learning goals and essential questions for this unit to use with the design competition's focus. If you participate in such a contest, make sure that you highlight for the youth the phases of the Design Process.

Learn more:

Design

- *Objectified*, the movie (<http://www.objectifiedfilm.com/stream/>).
- Girls Think of Everything, by Catherine Thimmesh

Inventors

- Lemelson Center - Study of Invention and Innovation, <http://invention.smithsonian.org/home/>
- *Innovative Lives: Exploring the History of Women Inventors*, <http://invention.smithsonian.org/centerpieces/ilives/womeninventors.html>
- Men and Women Inventors, <http://www.sil.si.edu/exhibitions/doodles/innovators.htm>

Form and Function

- Inventing Ourselves. Compare form and function of early prosthetic legs and hands with newer versions, <http://invention.smithsonian.org/centerpieces/inventingourselves/design.htm>

Women

- A Mother's Invention in Necessity http://invention.smithsonian.org/resources/online_articles_detail.aspx?id=300
- Julia Morgan, <http://www.juliamorgan.org/story.shtml>
- Women Inventors, Cobblestone Magazine, vol. 15, no. 6 (June 1994). Frances A. Karnes and Suzanne M. Bean, *Girls and Young Women Inventing* (Minneapolis: Free Spirit Publishing, 1995).
- Ellen H. Showell and Fred M.B. Amram, *From Indian Corn to Outer Space: Women Invent in America* (Peterborough, NH: Cobblestone Publishing, Inc., 1995).
- Annie Wood, *Canadian Women Invent!* (Toronto, Ontario: Inventive Women Inc., 2002).

Warm-Up

Time: 15 minutes

Purpose: Understand what design is.

Materials Choose any one of the following:

- Whiteboard
- Blackboard
- Flip chart
- Overhead projector

To Do

Identify design in your life

1. Call on a few youth to name their favorite technology or toy and why they like it. If they say “because it is fun,” push them for more information. For example, if Shayna says she likes her jump rope because it is fun, ask her whether it is fun because it is her favorite color, or because she can use it alone or with friends, take it to school with her, etc.



Gender Tips

Remind youth of the agreement: ‘no yucking my yum’. Commenting that someone’s favorite toy is “too girly” or “only for boys” is a ‘yucking my yum’. Encourage everyone to appreciate another person’s favorite, even if it’s not their favorite.

Connecting gender to ability (or lack of) or way someone or something looks or behaves is a slur. Just like a racial slur. Explain to youth that slurs (racial, gender, sexual orientation, age, etc.) are not cool and not welcome.

2. Use their descriptions to explain how the FORM and FUNCTION of these *designed products* make the products useful to them. For example, if Shayna says she likes her jump rope because she can carry it to school easily, explain that the form of the product (small and foldable) allows it to carry out its function better (a fun way for kids to exercise anywhere).

 **Challenge**

Time:	55 minutes
Purpose:	Understand what a user is and what it means to design for a user. Define a problem from a user's perspective.
Materials	All available materials that youth can use to create their designs. Make materials available on a table or some central location.

To Do

Develop a 3-D Design

1. Explain that in the Warm-Up volunteers described a toy from the *user's perspective*. Now they are going to experience some of the fun and challenge that designers experience. Ask youth to create something that someone (**not themselves**) they know needs. It can be anything that someone can use. Tell them that they can use any of the materials on the table to create their design for this usable thing. Each youth should individually make something. No groups for this activity.
2. Encourage youth to define the user's need. Ask them to think about how what they create helps their user.
3. Lead a whole group discussion. Ask each student to share: what they designed, whom it is for, and why that person needs it. Ask youth:
 - So once you decided who the user was, how did you decide what was needed? [Let youth explain, and then point out they identified a problem. Write this somewhere so all can see. Continue to write down ideas the youth say so you can map them to the Design Process poster.]
 - How did you get your ideas for your design? Would it have helped to talk with others? Who? [brainstorm, users input, discuss ideas with users and others]
 - How did you come up with the specific need? [helpful to know that earlier]
 - Now that you've developed a design, what would you do next? [get more input from users, build it]
4. Record youths' responses and say that all designers go through a similar process. Put up the Design Process poster. Be sure to hit some of the highlights of the Design Process. Describe each stage briefly, making connections to what the youth said, and let youth discuss.
5. If you have time, introduce the *Design Notebooks* and have youth sketch their designs and write responses to the questions: What did they design? Who is it for? Why does that person need it? If you can, rather than sketching, take a digital picture of each student's design and print it out so they can paste it into their *Design Notebook*.

Main Activity

Time:	55 minutes		
Purpose:	Understand that designed products are everywhere		
Materials	<ul style="list-style-type: none"> • Magazines • Glue 	<ul style="list-style-type: none"> • Scissors • Poster or butcher-block paper 	

To Do

Creating a Design Collage

1. Ask youth to think about all the things around them that are designed.
2. Refer back to youths' favorite technology and toys and what they designed for their users.
3. Point to objects in the room. Ask the youth: Is this designed? Ask the youth to explain what about it is designed and who (type of person and their knowledge) designed it. Point out a variety of things that have different designs: wastepaper basket, food & food packaging, clothing, the room itself, soccer field, lamps, computers. Point to things in nature that aren't designed to draw contrast to the majority of things around them that are designed by designers.
4. After this short discussion (5 minutes), ask youth to use pictures from magazines to create a collage that includes:
 - Things (objects and places) that are designed
 - Different types of designers (they can label these people).
5. Talk with the youth about the definitions of *design*, *form*, *function*, and *users*.
6. While the youth are creating their collages, choose a couple of inventors or designer stories to read from the books and websites list in the Getting Ready section. Post pictures of these people and their stories on the collage.



Gender Tips

Make sure there are both men and women designers equally represented in the collages. A variety of ethnicities and races should also be present.

7. When youth have completed their collages, ask each student to share why they chose two of the pictures on their collage, explaining the form, function, and user.
8. Display these collages around the room and leave them up as much as possible during ICT4me Unit 1.

Discussion/Reflection

Time:	15 minutes
Purpose:	Learn about ICT4me. Discuss how the recent activities fit into the “big picture” of ICT4me.
Materials	None

To Do

ICT4me Introduction

1. Refer to the Design Process poster. Explain that youth will have opportunities in the ICT4me curriculum to experience each of the stages in the Design Process several times, including having professional designers come in and design with them.
2. Open up the floor to a discussion about the youths’ experiences with design and technology, and their interest in technology jobs. This is an opportunity for you as the leader to find out more about what the youth already know. It is also a chance to teach the youth about the opportunities available to them and what they need to do to get there. Tell the youth that taking math classes is one step on the path to a technology job, and ICT4me will help them learn about these careers and how they use math.



Gender Tips

Address any gender misconceptions or stereotypes about gender and design as they arise (e.g., design is about fashion, there are no women inventors, jump rope is only for girls, only guys are interested in ICT professions).

In co-ed classes, make sure that boys and girls participate equally in whole and small groups.

3. If youth have questions about technology careers, have youth peruse the books, movie, and websites suggested in the Getting Ready section.

Week 2: What Type of Shoes?

Summary

Schedule

Warm-Up	Review form and function.	20 min
Challenge	Introduce “Define the Problem” using shoes.	45 min
Main Activity	ICT Professional speaks about youth career & leads brainstorming.	60 min
Discussion/Reflection	Questions for the ICT professional and/or Brainstorming	15 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Define the problem
- Brainstorm
- Sketch it



Materials

- Flip chart and markers
- Paper and pens
- Design Notebooks
- Any materials or equipment the ICT professional needs
- Flip chart and markers
- A variety of different styles of shoes (one of each instead of pairs is OK). For example: sport shoe, work boot, dressy shoe, sandal, child’s shoe, etc. If possible, acquire these from the place in your closet where old shoes go to die, thrift shops or garage sales. An alternative is to borrow one shoe from everyone in the session.

Note: Check with the manager of your middle school program to coordinate the ICT professionals' visits.

The ICT professional will work with the youth on brainstorming. If there is an office near you, we recommend contacting IDEO. IDEO is located in Palo Alto, San Francisco, Chicago, Boston, and international offices. Call 800-600-IDEO to see if there is a consultant in your area.

Send the professional the ICT Professional Packet to help them put together their presentation. Also share the plans for this week's sessions. Let them know that the learning goal is to understand the role of brainstorming in the Design Process and introduce the youth to brainstorming techniques.

Getting Ready

Overview

Youth will have the opportunity to explore the notion of the form and function of a common item: shoes! In doing so, they will learn how to define a problem and go through a process for generating ideas for the design of a new type of shoe. They will have an opportunity to interact with an ICT professional who uses brainstorming in their work.

Glossary

- **Brainstorming.** A process for generating ideas.
- **Sketching.** A way of very quickly creating drawings that express your ideas.
- **ICT professional.** A person who works in information technology (ICT). In ICT4me, ICT professionals are people willing to talk with youth about their careers in ICT and engage in an ICT4me activity with the youth.
- **Form.** What a design looks like, including the size, shape, color, texture, material, and features of an object.
- **Function.** What a user can do with a designed object.

Background

Defining the problem and brainstorming are the first two steps in the Design Process.

Defining the problem. Before you begin to design, you have to know what you are working toward. Designers look for problems in the world that they can help to solve. So a “problem” is not necessarily a bad thing—it’s a need or something that the designer sees as missing in the world. Designers try to help people do things more easily and quickly by recognizing problems, thinking about why they exist, and then coming up with ways to solve them.

For example, a designer might notice that a person at the gym has a water bottle but has to stop exercising to screw and unscrew the cap every time they take a sip. Why is this a

problem? Well, the exerciser doesn't want to spill water on the treadmill, so they have to keep the bottle closed. But they're missing valuable workout minutes every time they have to fiddle with the cap. The designer would recognize this as a problem and then try to come up with solution. As we know, this problem has been solved by the creation of the sport cap on water bottles.

Brainstorming. After a designer decides what problem they are working on, he/she begins a process of idea generation. Ideally, this is done in groups, because more people = more ideas. However, some people prefer to work alone, and that's an OK way to come up with ideas too.

Brainstorming usually involves a group of people in a room, working together to come up with solutions to a problem they've defined. It's a time for coming up with lots of ideas—no matter how crazy they are. No critique of ideas is allowed—the goal is to come up with lots of ideas, and later in the Design Process you will narrow down which ideas you might want to act on. People brainstorm with words (usually someone in the room writes down everything that is said, even if it gets repeated) or by sketching pictures of their ideas. One major reason why brainstorming is useful is that it helps to free us from “fixed ideas.”

An example of brainstorming comes from IDEO (<http://www.ideo.com/>), a company that helps other companies innovate by working with them to design products, services, environments, and experiences. IDEO is known for its brainstorming techniques. Here are the brainstorming rules that IDEO professionals follow:

- **Duration.** “Sixty minutes in an optimum length. The level of physical and mental energy required for a brainstorm is hard to sustain much longer than that.”
- **Don'ts.** “Brainstorming sessions aren't presentations or opportunities for the boss to poll the troops for hot ideas. Nor should they feel like work. And brainstorming is most definitely not about spending thousands of dollars at some glamorous off-site location.”
- **Idea engine.** “Brainstorming is the idea engine of IDEO's culture. It is an opportunity for teams to ‘blue sky’ ideas early in a project or to solve a tricky problem that's cropped up later on. The more productive the group, the more it brainstorms regularly and effectively.”

IDEO's Seven Principles of Brainstorming are:

- Defer Judgment: no telling your neighbor you don't like their idea
- Encourage Wild Ideas: the crazier, the better
- Build on the Ideas of Others
- Stay Focused on the Topic
- One Conversation at a Time: it's rude to speak while someone else is speaking—plus you might miss hearing a good idea
- Be Visual: sometimes it's easier to express yourself in a picture than with words

- Go for Quantity: you want lots of ideas, and you'll worry about quality later.

During brainstorming, it's helpful to sketch your ideas so that others can see what you are thinking. **Be alert to the possibility that some youth might resist the idea of drawing or sketching. They may protest that they can't draw and therefore can't do the assignment. It is important to acknowledge their fears but at the same time stress that all designers sketch out and think about their ideas on paper or on the computer.** The drawings are to help them think and share ideas. Designers don't worry about making their sketches perfect. In fact, they shouldn't be perfect. It's just a sketch or note to help everyone involved think better about what they are trying to do. **On the other end of the spectrum, some youth may spend a lot of time on their sketches, making them very elaborate. Set a time limit and specify the level of detail.**

Learn More

Examples of sketches of famous inventions,
<http://www.sil.si.edu/exhibitions/doodles/cf/working.cfm>

Choose ICT professionals who reflect the gender and race of the youth in the class. Be sure to go over the intent of the curriculum to encourage underrepresented populations in ICT so that the ICT professionals can prepare a presentation that welcomes all to the profession.

Focus the conversation on the function of the shoe type and not the gender that wears it.

Warm-Up

Time:	20 minutes
Purpose:	Continue to explore form and function.
Materials	A variety of different styles of shoes (one of each instead of pairs is OK). For example: sport shoe, work boot, dressy shoe, sandal, child's shoe, etc. If possible, acquire these from the place in your closet where old shoes go to die, thrift shops or garage sales. An alternative is to borrow one shoe from everyone in the session.

To Do

1. Quickly review with the youth what they did last week:
 - What is design?
 - What is form?
 - What is function?
 - What around them is designed?
 - Who is a user?
2. Pile up a collection of shoes. Lead the youth in a discussion of the form and function of each type of shoe. For example, a dressy shoe's form might be a high heel with a pointy toe, and its function is to make the user look taller and dressed up.
3. Allow the youth to try on the different types of shoes as they are figuring out the form and function.



Gender Tips

Some youth may stereotype shoes as a 'girl thing.' Make sure you have a variety of types of shoes. Encourage youth to see the variety of shoes that we all use and their importance in meeting our needs (sports, work, safety, warmth, comfort).

Especially in mixed and boys-only setting, make sure that boys consider the purpose and function of women's style shoes.

Make sure that boys and girls participate equally in mixed groups.

4. Ask: "How are these shoes alike, and how are they different from one another?" Help youth identify similarities (what makes a shoe a shoe) and differences (materials; kind of heel; slip-on, laces, or velcro; color; style; decorations; etc.).
5. Ask: Why are these shoes different from one another? Why don't all shoes look alike? What kinds of things do you think shoe designers consider when they design these shoes?

Youth should come to the conclusions that different kinds of shoes serve different purposes or *functions*, and that affects how they look, and that shoe designers think not only about what a shoe looks like but about its function as well.

 **Challenge**

Time:	45 minutes
Purpose:	Introduce youth to the first step in the Design Process, Define the Problem.
Materials	<ul style="list-style-type: none">• All types of shoes (see above)• Design Process poster• Design Shoe Challenge handout / poster• <i>Design Notebooks</i>

To Do

1. Point to the Design Process poster, and tell youth that the first step in designing typically is “defining the problem.” Ask what they think that means for a designer. Listen to the youths’ responses.
 - If youth have difficulties with the term, provide them with a narrower situation. E.g., what would “defining the problem” be when considering how they could improve their performance in a specific activity, such as a sport in which they are currently participating.
2. Tell youth: Designers look for problems in the world that they can help to solve.
 - A “problem” is not necessarily a bad thing—it’s a need or something that the designer sees is missing in the world.
 - Designers try to help people do things more easily by recognizing problems, thinking about why they exist, and then coming up with ways to solve them.
3. Divide the group into trios. Say: “You are going to start to be designers by defining a problem that a specific type of shoe could solve. The users are youth like you.” If they need help, give them some examples: school shoes are designed to be both fashionable and comfortable; running shoes are designed to support someone who runs (cushion to prevent injury, arch support, etc.).
4. Teams should:
 - Identify the user of the shoe (it can be more specific than youth, such as middle schooler in California).
 - Identify the problem that user has.
 - Describe how the shoe will address the problem.
 - Write down their ideas in their *Design Notebooks*—they will need this information at the next session.
 - Draw some ideas they have for how the shoes will look (form) and perform (function).

 **Gender Tips**

As you walk around, check that youth are focusing on the needs of the user, not his/her gender as proxy for need.

Make index cards each with users of varied gender, race, age and needs to hand out to teams in single-gender settings, if necessary.

Encourage all youth to draw.

5. Gather the youth back together. Have each group present the user they picked and the problems they defined for a type of shoe. Capture these ideas on the board. Point out when youth make connections to form and function. Tell the youth that this presentation is practice for next time, when they will tell the ICT Professional about the problems they identified.

 **Gender Tips**

In co-ed groups: Select 2 youth to report out from each group, one male and one female. Ensure you rotate who speaks first in the sharing out to create gender balance in reporting out to the full group.

6. Talk about the process of defining the problem. Was it easy to come up with a problem? Difficult? How did they get their ideas for the problem and some possible solutions?

 **Main Activity**

Time:	60 minutes
Purpose:	Introduce the youth to the second step in the Design Process, Brainstorm.
Materials	ICT professional and audiovisuals (computer, LCD projector, overhead, etc.)

To Do

ICT Professional-led Brainstorming (Alternative A)

1. Introduce guest speaker, stating his/her name, job, and place of work. Tell the youth that the ICT professional is going to talk about their job and lead them in brainstorming.
2. The ICT professional gives their presentation on their career and career path (see ICT Professional Packet for details on what they should cover).



Gender Tips

Be sure to prep ICT professional around gendered language, stereotypes, etc. so that they share examples of both genders and a variety of races, working in ICT.

3. Ask the youth to tell the ICT professional about what they did last session—the shoes they looked at and the problems they defined.
4. The ICT professional should then take the youth through the steps of brainstorming (either IDEO's steps in the Activity Sheet or the steps they use in their work).
5. The ICT professional should then lead the youth in a brainstorming session, using the problems they identified with shoes as a jumping-off point.
6. In the last 10 minutes, youth review their brainstormed lists to pick the ideas that would help them actually design new shoes, and sketch the shoes in their *Design Notebooks*.

Staff-led Brainstorming (Alternative B)

1. Have the youth choose a problem they identified and then brainstorm ideas for shoes to address the problem. It's best to choose one problem. If you think the youth will be upset if their problem isn't the focus, choose a common middle school problem for them.
2. Use sticky notes for youth to write down their ideas.
3. Have youth come up with as many ideas as they can in 10 minutes. Encourage drawing.
4. Refer to the IDEO ground rules for brainstorming in the Activity Sheet.
5. Ask youth to share their ideas with the whole group and post them on the board.
6. As youth post ideas, ask them to start grouping them with similar ideas.
7. This grouping should encourage youth to generate more ideas. Post any additional ideas.

 **Discussion/Reflection**

Time:	10 minutes
Purpose:	Questions for the ICT professional and/or Brainstorming
Materials	None

To Do

1. Ask youth to reflect on how brainstorming can help them. Why is it important to generate lots of ideas before deciding on a solution? [Reason: getting many ideas from a variety of people with no limitations will often generate a solution better than what one person could think of on their own.]
2. Ask youth how they might choose one or more solutions from the brainstorming [Consider available resources, which one best addresses the problem, maybe take a couple of ideas into design and run by users].
3. What brainstorming techniques do they want to try the next time they design and why? [ICT professional might describe some other techniques in addition to the one they demonstrated with the youth. Youth might also want to work together or generate ideas out loud and respond to each other's ideas.]
4. Allow the youth a few minutes to ask the ICT professional any questions they have, either about their career or about the Design Process.
5. Thank the ICT professional for their time.



Gender Tips

In co-ed settings, foster a balance of both boys and girls sharing out and asking questions of ICT professional.

Week 3: Gizmos, Gadgets & Dream Machines

Summary

Schedule

Warm-Up	Peanut butter and jelly sandwich sequence.	30 min
Challenge	Youth learn to storyboard.	45 min
Main Activity	Youth invent Dream Machines.	50 min
Discussion/Reflection	Youth share machines and storyboards with group.	20 min
Total Time		2 hr 25 min

★ Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Sketch it—Storyboarding is a popular structure for design sketches.
- Develop designs.



Materials

- Bread, peanut butter, jelly, plates, knives (can be done with other ingredients if necessary)
- Storyboard Template handout
- Storyboard Examples handout
- Paper
- Simple machines that youth use: electric toothbrush, toaster, can opener, curling iron, blow-dryer, electric drill, CD player, etc.
- Markers, crayons, pens
- Design Notebooks

Getting Ready

Overview

Youth will use storyboards to describe Dream Machines of their own invention. First, youth learn about the concept of *sequencing*, then *storyboarding*, as a way to capture these sequences. The youth use storyboards to demonstrate the sequential flow of the functionality of their Dream Machines.

Glossary

- **Designs.** Drawings, descriptions, instructions, and diagrams, about how to build the design.
- **Sketching.** A way of quickly creating drawings that express your ideas.
- **Storyboarding.** A technique used by designers that is a series of sketches that shows (1) form, (2) function, (3) sequence of use, and (4) scenarios of use of a product. A storyboard shows the size, shape, color, texture, material, and features of an object. A storyboard shows the purpose of an object.
- **Form.** A storyboard shows what the object looks like, including the size, shape, color, texture, material and features of an object.
- **Function.** A storyboard shows how a user can use an object.
- **Scenarios of use.** A storyboard tells the story of how something is used (versus. a sketch, which is static and shows only one moment).
- **Sequence of use.** A storyboard shows the steps for using an object.

Background

A storyboard is a way of visually representing what a product is, how it works, and how people use it. For example, for an ATM, designers use a storyboard to demonstrate all the features of the machine and how people (users) interact with the machine, taking out money or making deposits.

The Advantages of Storyboarding

- Helps people understand a product idea and see potential problems in the design
- Acts as a reference point for members of the design team (including the client)
- Helps people visualize the final product—a picture is worth a thousand words

Storyboard Template

Give youth a copy of the Storyboard Template. They may need more than one sheet if their storyboard has more than six frames.

Each frame includes the project title to indicate what project all the sketches are part of, screen name, screen number for sequencing, a drawing in the large box, and a caption below explaining what the drawing is. Here's an example.

Project Title: *How an ATM works*

Screen Number: *1*

Screen Sketch



Describe the Action

Person inserts card into ATM card slot

Warm-Up

Time:	30 minutes
Purpose:	Youth learn about <i>sequence of use</i> .
Materials	<ul style="list-style-type: none">• Bread• Peanut butter• Note: If peanut allergies are a problem, you can do this activity with almost any procedure—making a bowl of cereal, playing a CD in a CD player, etc.• Jelly• Plates, knives, napkins

To Do

1. Divide group into teams of three or four.
2. Tell teams that their job is to explain to an alien—their ICT4me facilitator—how to make a peanut butter and jelly sandwich, one step at a time. (If possible, have a second facilitator so that two teams can be giving their instructions at the same time). The alien is from a planet that does not have peanut butter and jelly. They do not even know what a sandwich is! Teams have to make sure the alien knows exactly how to make a PB&J sandwich.
3. Have teams write down a list of steps they will ask the alien to follow. Tell them to number the steps. Order is important!
4. After about 10 minutes, call the teams together. Have the first team give their instructions to you. Follow along, using the actual ingredients to make the sandwich. Make sure to follow their instructions precisely—even if it means doing something silly. For example, if youth say, “Now spread the peanut butter,” you can ask where, or just start spreading it on the plate or your finger instead of the bread. The idea is that the youth will learn to break down procedures carefully and precisely into all the steps.
5. Optional: give teams an opportunity to revise their instructions after the first “sandwich.”
6. Go through this process with each of the groups. Debrief the youth about sequence of use at the end of the activity. Ask why is order important? Why is precision and clarity important? [Explain that designers often work with people who actually make designs, and that they may not be in the same room or even the same country.]

 **Challenge**

Time:	45 minutes
Purpose:	Youth learn about storyboarding.
Materials	<ul style="list-style-type: none">• Storyboards Example• Storyboard Templates• Simple machines that youth use: electric toothbrush, toaster, can opener, curling iron, blow-dryer, electric drill, CD player, etc. <ul style="list-style-type: none">• Paper• Markers, crayons, pens• <i>Design Notebooks</i>

To Do

1. Tell the youth that what they did in the peanut butter activity was a step leading up to doing what designers call “storyboarding.”
2. Explain that storyboarding is a technique used by designers to show (1) form, (2) function, (3) sequence of use, and (4) scenarios of use.
3. Have a conversation with the youth about the glossary (see page 1). Some conversation starters include:
 - What does form mean?
 - What does function mean?
 - Describe the form and function of this light, computer, etc.
 - Has anyone ever used a storyboard? [a comic strip is a simple Storyboard]
 - What does a Storyboard include? [Scenario (story), sequence of use, form, and function].
4. Show examples of storyboards and how they exhibit form, function, sequence of use, and scenarios of use. See Storyboard Examples.
5. Pass out Storyboard Templates.
6. Set up stations for the youth to use the simple machines. Give youth time to look through the gadgets. Talk about their designs, their functions, and how they work. Encourage youth to look closely at how the parts (if any) of the gadget work together.
7. Ask youth to think about the gadgets: What are these things? What problem or need do these objects address? What do these things do? Give youth plenty of time to try out the gadgets so they can see the differences and similarities among them.
8. Ask youth about the sequence of motions involved when each gadget is used: What do you do first? What happens then? What effect does that have?

9. Ask youth to choose one of the machines and storyboard its use. For example, the Storyboard for the CD player might have four screens: (1) open CD package, (2) open CD player, (3) insert CD and close CD player, (4) push play and music is heard by user(s).



Gender Tips

Make sure that everyone is handling the machines and making storyboards.

 **Main Activity**

Time:	50 minutes
Purpose:	Youth practice storyboarding.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Paper• Markers, crayons, pens• Storyboard Templates

To Do

1. Youth will practice storyboarding. They will come up with a “Dream Machine” that solves a problem that someone they know has. They will use a storyboard to show the steps using the Dream Machine and to show all of the machine’s features.
2. Remind the youth to use the Design Process steps to invent their Dream Machine. They should use the following steps:

- Define the Problem
- Brainstorm
- Sketch
- Storyboard

Youth should not spend a lot of time coming up with the machine—remind them they need to quickly choose an idea so they have time to make the storyboard.

3. Group students into pairs.
4. Pass out Storyboard Templates.
5. Circulate among the groups while they are working. Make sure the youth are using the steps in the Design Process.
6. In addition to completing the sections of the storyboard, you might ask the youth to come up with criteria for good storyboards. For example, using Form, Function, Sequence, and Scenario, the reader of the storyboard would now consider: (1) Form: what the machine looks like including color and shape; (2) Function: how it works; (3) Sequence: the sequence for any operation the machine can perform; and (4) Scenario: what the user experience is of the machine.

 **Gender Tips**

Help youth really think out of the box for their Dream Machines. If gender stereotypes arise, refocus the attention on thinking about the users’ needs, and the machine’s form and function.

 **Discussion/Reflection**

Time:	20 minutes
Purpose:	<ul style="list-style-type: none">• Youth share Dream Machine ideas and storyboards with the group. Understand how each storyboard displays the machine’s form, function, sequence of use, and scenarios of use.• Youth reflect on how storyboards help the designer and the audience (team members, users, etc.) to understand how the machine works.
Materials	<ul style="list-style-type: none">• Completed storyboards by youth Put these storyboards in students’ <i>Design Notebooks</i>

To Do

1. Return to the large group after students have completed their storyboards.
2. Have the pairs present their storyboards to the group one at a time. Encourage the youth to ask questions and give feedback to the presenters.
3. Prompt questions about the form, function, sequence of use, and scenarios of use. Ask how each storyboard met the standards the group set.

Week 4: Things That Fly

Summary

Schedule

Warm-Up	Introduce the Things That Fly project.	20 min
Challenge	Outdoors: Averages and throwing Indoors: Online research using the Internet	50 min
Main Activity	Create your own.	50 min
Discussion/Reflection	In the Design Process, reflect on research and prototyping.	20 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Research it: “How would you develop a better Frisbee or other flying toy (e.g., Aerobie, boomerang) than what’s available today?”
- Develop designs
- Create prototype



Materials

- Design Process poster
- Flying discs. Have different types of flying discs available, including a boomerang, Aerobie, plastic Frisbee, and cloth Frisbee. Have enough so that groups of students can be working with the different types simultaneously.
- Design Notebooks
- Materials to make flying machines, e.g., cloth, plastic, windbreaker material, cardboard, silk, netting, popsicle sticks, other types of sticks that would be flexible. See URLs for more ideas.

- Tape measure. The best kind is long and sturdy carpenter’s tape. Imagine how much time and precision it would take to measure 30+ feet with a yardstick!
- Electronic activity page: Websites for Flying Objects
- Activity Sheet: Math That Matters—How Far Does Your Frisbee Fly?
- Computers with access to the Internet
- Markers, such as a cone, that youth can drop to mark where they threw the disc from. The disc, once it is thrown, acts as the other marker.
- Calculators, if available (computers have calculator feature).
- Clipboards

Getting Ready

Overview

Youth learn the next three steps in the Design Process (Research it, Develop designs, and Create prototype) and how technology and math can help in design. The youth will be researching, developing designs, prototyping, and testing flying objects.

Glossary

- **Average.** The sum of a set of quantities divided by the number of quantities in the set. So, the average of 2, 3, 7 is 4 ($2+3+7=12/3=4$). Another name for *average* is *arithmetic mean*.
- **Research.** Investigate or find out more about something in order to inform the design plans and the design itself.
- **Prototype.** An example that has most of the features of what will be built based on a design. A prototype is not the final form but gives an example of what the final product will look like and do.

Background

Spend some time reviewing the websites, other sources for the history and design of flying discs, and the math activity.

A female facilitator’s attitude towards math is highly correlated with girls’ positive attitudes toward and success with math. Encourage hard work and persistence to do the math activities (just like any other activities in this unit).

Websites and other sources for history and design info:

See Activity Page Websites for Flying Objects.

Some book suggestions:

- The Complete Book of Frisbee: The History of the Sport & the First Official Price Guide by Victor A. Malafronte and F. Davis Johnson
- About Boomerangs, America's Silent Sport by Kelly B. Sagert
- Boomerangs: How to Make and Throw Them by Bernard S. Mason
- Boomerang: Behind an Australian Icon by Philip Jones
- The Aerobie Book: An Investigation into the Ultimate Flying Mini-Machine by John Cassidy

Math activity:

The key concept for the math activity is that mathematics can help designers research the design of existing objects and design new objects.

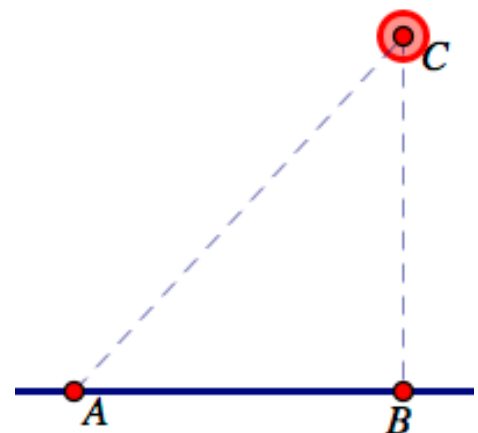
You'll help youth apply the concept of finding an average, or the arithmetic mean, in order to understand which type of disc can be thrown the farthest (by a middle school student). The students will likely have encountered the concept of *average* in school math class but may have forgotten. The average is a single number that you can use in place of a range of different numbers to represent a concept, such as the distance a type of disc will travel when thrown by a middle school student. For example, suppose that one student throws the disc 20 feet, a second student 30 feet, and a third student 40 feet. The average distance is 30 feet. The youth have different abilities in their throws but are experiencing the same weather conditions, are relatively close in age, and are using the same disc. To get an even better representation of the distance the disc can travel, you might have people of different ages and abilities throw it.

Taking the average of distance thrown captures how far each disc can be thrown. Youth might also decide to compare discs based on other criteria, such as height of flight and trueness to intended direction. If students show an interest, encourage them to explore how they might measure and find the average of these other comparisons.

While calculating averages is mostly straight forward, don't rush youth through the logistics to do the number crunching. There are a few more math consideration in the set up.

How to measure? Using measuring tape might be new to the youth. Ask youth to help you demonstrate how to measure. You can also mock incorrect measuring techniques (like not bending the measuring tape, when measuring height or a corner).

Imagine that flying object starts at A and ends in C. Should the youth measure from A, diagonally, so to speak from the starting position? Or should they measure from B, the closest position from the object, still taking into account the starting "line"? There is no right answer, as long as everyone in the class is measuring the distance in the same way.



Ask: What is the starting point for measuring? Do you measure from the starting position to the center of the object or to the edge of the object? Do you take into account the wind? If so, do you measure diagonally?

How to read the measuring tape? This is a non-trivial skill. Discuss the numbering on the tape measure - how to read the inches and feet. Include the fractions of an inch and decide with the youth if they'll measure in inches, in fractions of an inch, in feet, or in some combination of these. If you need to review, see <http://www.carllswoodproducts.com/tapemeasure.html>.

What unit to use? Since you are using measuring tape, you'll likely be using English measures (instead of metric). If youth decide to measure in feet AND inches, they will have to convert to one or the other for averaging purposes. And that raises another mathematical task (which is fine, but may detract from the main goal of the activity). Consider suggesting that youth either measure in rounded up / down feet, or all in inches. You can convert to feet afterwards.

How precise to be? Rounding up or down to the nearest foot may be sufficiently precise. Discuss how to do this (rounding) before you set them loose (i.e., round up if more than 6 inches, or down if less). But some youth will be driven by a competitive desire to fly the objects the furthest, and they may insist on measuring in inches. Remember that the goal of the activity is to gather information about which flying object flies the furthest or the best, and precision may take away from this overall objective.

How to combine the averages from each team? Depending on what kinds of materials you have, some teams may be testing the same flying object (the same brand of Frisbee, for example). When you get back together as a class to share out the data, you may want to discuss taking the average of the averages for those objects. Because each team will be throwing an object 3 times, doing the same operation (averaging) is ok. However, this does not always work (hence the use of weighted averages). So, the best way to do this simply is to average all the original distances for one object (i.e., if you had 7 throws for one object, re-add them up and divide by 7).

Warm-Up

Time:	20 minutes
Purpose:	Introduce the Things That Fly project.
Materials	Design Process poster

To Do

1. Tell the youth that they are going to begin a week where they get to investigate the design of things that fly.
2. Explain that they will focus on flying objects that can be thrown—like Frisbees, boomerangs, and Aerobies. Show the youth some examples of these objects.
3. Get a feel for whether or not students have compared flying discs at all before. Ask the youth if they have played with one or more of these objects before. If yes, do they have a preference for which ones they like to play with? Encourage the youth to talk about what they look for in a flying disc. Also find out if any of them have a different one than the ones you've brought. If so, encourage the student(s) to bring the toy(s) next time. During this week, they'll get a chance to compare flying discs and create their own "ultimate flying toy."
4. Give an overview of the project for the youth, using the Design Process poster:
 - Point out that they have already done Define the problem, Brainstorm, and Sketch it.
 - Now they will work on Research it, Develop designs, Create prototype, and Test it with their designs.
 - Ask the youth if they have questions about these steps. Do they know what each term means?
 - Their research question for this project is: "How would you go about developing a better Frisbee or other flying toy (e.g., boomerang, Aerobie) than what's available today?" In other words, "How would you design the ultimate flying toy?" Notice that the focus is on the Design Process, rather than just the end product of creating some flying toy.
5. Tell the youth that they will have a chance to see how technology and math can help them do research to inform their designs.

Challenge

Special Note. Students throw the flying discs **outside**, measure their throws, and take averages; students use the **Internet** to research the history and design of the discs. If you only have time for one, do the outside activity.

Option 1: Research Throwing Flying Discs

Time:	50 minutes	
Purpose:	Youth play with flying objects and collect data on their functionality.	
Materials	<ul style="list-style-type: none"> • Flying objects • Tape measures • How Far Does Your Frisbee Fly? Worksheets 	<ul style="list-style-type: none"> • Clipboards • Calculators, if available

To Do

15 minutes

1. Introduce the youth to the idea of collecting data to answer a research question.
 - Why collect data? [We are conducting research—trying to understand an object and how it works so we can design a better one.]
 - What sort of information might they want to learn about the flying objects? Prompt youth for things they might want to know about an existing flying toy: how high it goes, how far it goes, whether it flies in the direction the user intended, etc.
2. Give the youth an example of one way to collect data on how far a Frisbee can go: purposely throw the Frisbee poorly, measure the distance, and write it down. Ask them if they think that’s good data on how far a Frisbee flies.
3. Elicit from the students that a better way to collect data would be to throw the Frisbee multiple times with different throwers. Then they can **average** all the throws.
4. Ask if any of them know what an average is. Use a concrete example: Suppose that one student throws the disc 20 feet, a second student 30 feet, and a third student 40 feet. The average distance is 30 feet. Show youth how to do averages.
5. Divide the youth into trios. Pass out the How Far Does Your Frisbee Fly activity pages (one per trio) on a clipboard and read through it with the youth. There are three jobs: throw the object, measure it, and write down the distance. Each youth gets to throw each object once. The other students will help measure and write down the distance.

When they have collected the measurements on the three throws, they will take the average.

6. Pass out measuring tapes & discuss measuring logistics:
 - How to use and read the measuring tape. Have youth who are familiar with the tool demonstrate.
 - Choose a measuring unit or units.
 - Decide how precise to be.
 - Decide where you will measure from and to (e.g., from the start marker to the closest point or the center of the discs).

20 minutes

7. Go outside to throw flying toys. Assist them with their measurements and recording.



Gender Tips

Encourage collaboration rather than competition in this activity. Remind everyone that the goal is to gather data for the whole group; that this is not a competition to see who can throw the furthest, but rather, to determine which object flies the furthest, and that's why we are averaging all the throws for each flying object.

15 minutes

8. Go inside. Ask teams to find averages. Pass out calculators or use calculators on laptops, if available.
 - If necessary, have the student tell you how to calculate an average or have them demonstrate so everyone can see.
 - If necessary, combine the measurements of two or more teams using the same object.
9. On a shared screen / chart paper, write down the name of each object and ask youth to tell you the average distance flown. You may rewrite them in order of lesser to greater distance.
10. Discuss issues of measurement, precision, unintended challenges (wind, throwing ability) that you or the youth witnessed during the gathering of data. Taking the average of distance thrown captures how far each disc can be thrown by middle school youth. Youth might also decide to compare discs based on other criteria, such as height of flight and trueness to intended direction.
11. Ask, how can this data inform their designs?
12. Collect and save the worksheets for next time.

Option 2: Internet Research on Flying Disc Design

Time:	50 minutes
Purpose:	Give youth the opportunity to learn more about the history of flying discs, how they work, and the materials used to make them.
Materials	<ul style="list-style-type: none">• Websites for Flying Objects worksheet• <i>Design Notebooks</i>• Computers with Internet access

To Do

1. Ask youth: “How might you find out or research what flying toys are available today?” Explain that designers use research to determine what already exists and what users want. Youth may say go to toy stores, look at the ones my friends and I have at home, look on the Internet, etc.
2. Ask youth what kinds of things they would want to find out about a product they were going to design.
3. Divide the youth into pairs or groups of three.
4. Assign or allow pairs/groups to choose a flying disc to research (boomerang, Frisbee, or Aerobie). Make sure that each type of object is covered by at least one group. If possible, make sure each group has a student who is comfortable using the computer.
5. Ask youth to look for information on the following subjects. They probably will not find all the answers, so this list is a guideline. It’s ok if they find other information too.
 - Who invented the flying object?
 - When was it invented?
 - What purposes does it (or did it) serve?
 - Who uses it?
 - What is it made out of?
 - How big is it?
 - What shape is it?
 - How does it work?
6. Pass out worksheets to each group. Help youth to open an Internet browser and go to the web addresses (URLs) provided on the activity page for their assigned object. You may wish to use this activity page electronically.
7. Instruct them to keep track of the information they find in their *Design Notebooks*.
8. During the last 10 to 15 minutes of the session, have groups present their findings to one another. Explain that they will use all this information—what types of flying objects there

are, who uses them, what purposes they serve, what shapes and sizes they are—when they design their own, better flying object.

Main Activity

Time:	50 minutes	
Purpose:	Youth create designs and a prototype.	
Materials	<ul style="list-style-type: none"> • Design Process poster • <i>Design Notebooks</i> • Completed Activity Pages from Challenge 	<ul style="list-style-type: none"> • Materials to make flying machines, e.g., cloth, plastic, windbreaker material, cardboard, silk, netting, popsicle sticks, other types of sticks that would be flexible. See URLs for more ideas.

To Do

1. Put youth back into the pairs or groups of three that they were in to collect data last time.
2. Let youth know that today they are going to get a chance to develop the “ultimate flying toy.”
3. Remind youth of the averages they took last time. Distribute their completed worksheets. Ask youth:
 - “What else besides distance thrown might we compare across flying discs?” [height, intended direction] “How might you measure these?”
 - Anything else you think users would care about in the ‘ultimate flying toy’?
4. Ask youth to use their *Design Notebooks* to write down and sketch their design ideas, following the Design Process. You might write the following prompts on the board for youth to respond to in their *Design Notebooks*:
 - Define the problem: What’s the problem that you see with existing flying toys, based on your research?
 - Brainstorm: What ideas do you have for addressing these problems? [Talk with youth in your group.]
 - Research it: Summarize what you learned from your research. [Youth can just include their worksheets and any other notes if that’s easier.]
 - Sketch it: Do a quick (not perfect!) drawing of what you want to build.
5. Test it: Once they’ve written down their ideas, have youth create a prototype and try throwing it outside. Their throwing of the prototype is the test of the prototype. Does it do what they wanted? If some groups have time, they can make modifications.
6. Have youth return to their *Design Notebooks*. Have youth write one sentence, or draw if they prefer, what happened when they threw their prototype.

Discussion/Reflection

Time:	20 minutes
Purpose:	Wrap up and reflect on the role of research in the Design Process.
Materials	<ul style="list-style-type: none"> • Youths' prototypes • Design Process poster

To Do

1. Bring youth back to the large group.
2. Ask youth how they used math in the design process. Then, discuss the math courses youth will need to take in middle and high school to pursue many careers. Emphasize that completing higher level math classes in high school (algebra and above) opens up college opportunities, not just in math-related careers!
3. Give each pair or trio the opportunity to present their prototype and *Design Notebook* summaries.



Gender Tips

Encourage everyone's voice to be heard and their participation appreciated

4. Tell youth that designers often find new ideas through research. Ask each group: "How did your research of how potential users use a flying disc influence your thinking about your designs for a new flying disc?" If they need prompting, remind them of the overarching research question: "How would you go about developing a better Frisbee or other flying toy (e.g., boomerang, Aerobie) than what's available today?" Responses might include:
 - The cloth Frisbee with the weight flew farther than the plastic Frisbee, so we built our prototype out of cloth. We tried making one with a hole and one without, given that youth could throw the Aerobie farther than several other discs.
 - We chose to model ours after the Aerobie since it was thrown higher and farther than any of the other flying discs.
5. Conclude by asking the large group: "What role does research play in the Design Process?" Encourage youth to talk about investigating users' needs (e.g., throw it farther, higher, straighter) and preferences (e.g., color, size, which of the three flight characteristics matters most).

Week 5: The Perfect Hangout: Interacting with Users

Summary

Schedule

Warm-Up	Introduce the Perfect Hangout. Present the checklist.	25 min
Challenge	Prepare questions to ask users.	30 min
Main Activity	Discuss engaging with users during ICT professional's visit.	60 min
Discussion/Reflection	Interact with users.	10 min
Total Time		2 hr 10 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Review Design Process concepts, including that the Design Process is not linear.
- Focus on understanding users' needs and design iteration.

Materials

- Design Notebooks
- Design Process poster
- Pens or colored pencils
- Checklist for the Perfect Hangout
- Audio-visual equipment the ICT professional needs (computer, LCD projector, overhead, etc.)

Note: Check with the manager of your middle school program to coordinate the visits of the ICT professionals

Getting Ready

Overview

The Perfect Hangout project runs for 4 consecutive weeks (5, 6, 7, 8), with two ICT professional visits, culminating in a performance task in Week 8. During this time, youth will demonstrate that they understand that the goal of design is to satisfy client needs within particular constraints by designing an ideal hangout room for a pair of youth in the program and the students' friends. Youth will work in pairs to learn about another pair's wishes for the room, construct a design plan of a hangout room for this pair, and iterate on that plan based on feedback from users. In constructing the plan, the primary constraint will be that youth must use available materials and not invent their own objects for the room.

Prepare for introducing the youth to the next 4 weeks, by reviewing those weeks. The checklist plays an important role in setting the criteria for the designs. In the first session (Week 5), introduce the youth to the checklist. Refer to it again in Week 7 when the youth are preparing their model rooms and in Week 8 when youth reflect on each other designs. You can also use the checklist with any professionals or at Family Tech Nights to showcase youths' understanding and achievement.

Glossary

- **Iterate (also iterative, iteration).** To say or do something again to make something better. In the Design Process, you obtain feedback on your design from users so that you improve your design.
- **Users.** The people who need what a designer has created. Many creations have more than one type of user, especially if the product is for sale. For example, a perfect hangout may be bought by parents but used by middle school youth.
- **Brainstorming.** A process for generating ideas.
- **Sketching.** A way of quickly creating drawings that express your ideas.
- **Researching.** Investigating what exists currently to solve the same or a similar problem. Research can occur throughout the Design Process. It may involve investigating what users want or identifying materials and other resources to support the design and its implementation.
- **Designs.** The plans (drawings, models, or descriptions) for creating something.
- **Prototype.** A semi functioning design. A prototype is a way of showing a user how something will eventually work.
- **Testing.** There are two types of testing in design: user testing and quality assurance testing. In user testing, the designs, prototypes, or implemented product are shown to users in order to get feedback on the design from users. In quality assurance (QA) testing, the product is complete and is rigorously used in order to detect problems (often referred to as bugs) with the product.

Background

Professional designers take great care to ask questions that get at what people want to do with something they are designing, rather than asking questions about whether users like this feature or that. Designers also spend time understanding how the design fits into the users life. You'll want to help youth think about what kinds of questions will be most useful to elicit clients' or users' needs for the room and how it fits into their lives.

It's important that youth continue to incorporate users' needs rather than their own. Youth in this activity may have a tendency to want to copy each other's designs. Good designers do borrow from what others have done; however, the primary criterion by which youths' work is to be measured in this activity is whether their designs meet their clients' needs. Built into the activity are opportunities for youth to get feedback on their designs from their clients, which will help keep their desire to copy others' designs in check.

Youth will be working in pairs for the next four weeks. Carefully consider personality, gender, and skills when pairing up students. During the next few weeks, make sure that each partner has specific responsibilities during each task. For uneven tasks, make sure that both pairs have an opportunity to try the active role. For example, if using a computer, try pair programming. In pair programming, one student acts as the "driver" - using the mouse, and the other student acts as the "navigator" - telling the driver where to click and what to do. After 10 minutes or so, they switch roles, so that both students get to be drivers and navigators.

Incorporating Technology

There are technology tools available for 3D design, such as Google SketchUp (<http://www.sketchup.com/>), that youth can use instead of the physical materials (clay, etc.) or in addition to if you have more time for this unit. Plan to spend at least one session introducing the youth to the software.



Tech Tips

To give everyone a chance to work with computers, use *pair-programming*. Give the first youth 10 minutes to be the "driver" of the computer (moving the mouse/typing on the keyboard), while his/her partner is the "navigator" (telling the driver what to do.) Then switch roles for the next 10 minutes, so that both youth get at least 10 minutes to be drivers and 10 minutes to be navigators.

Warm-Up

Time:	20 minutes
Purpose:	Introduce the Perfect Hangout Project.
Materials	<ul style="list-style-type: none">• Checklist for the Perfect Hangout• Design Process poster

To Do

1. Walk youth through the next 4 weeks of what they will be doing. Include going over the Checklist.
2. Tell youth that they will be designing and building a model hangout room for two of their peers in the group and their friends. The sky is the limit for what they want to include in the room: money is not a limitation on what they can imagine.
3. Use the Design Process poster to show youth the types of things they'll create. For example, you might put up pictures on the Design Process poster of the checklist next to Define the problem; talking with users next to Research it; storyboarding next to Sketch it; and a model of the room next to Create prototype.

 **Challenge**

Time:	35 minutes
Purpose:	Prepare questions to ask users and discuss other techniques for learning how youth will use the room.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Pens

To Do

1. Put youth into pairs.
2. Ask the youth to brainstorm a list of questions they could ask their peers about what might go in a hangout room. Encourage youth to ask questions that get at deeper needs and desires than simply, “Would you like the room to have a stereo.” Instead, ask them to consider questions that get at the students’ deepest desires for what they want in an ideal hangout room. Some example questions include:
 - What is something you’d really like to be able to do at home with friends?
 - Why do you need the room?
 - Would you like the room to feel bright and open or closed and private?
 - Who can go in the room and whom do you want to keep out?
3. Provide one or two examples for the youth to use to get started, if they have trouble coming up with ideas.
4. After youth have written down some questions, ask them how they’ll find out what technology needs to be in the room. Ask a few students to share their ideas. Give youth some more time to write down questions.
5. Now ask the youth, besides asking questions, how might you find out more about how the pair will use the room. Let students suggest ideas: for example, observe youth in other hangout spaces, such as a lounge. Have users write a story about their using of the space.
6. Let youth know that an ICT professional who has experience learning how to meet the needs of users will be visiting. Provide details when you have them about the ICT professional. What questions do the youth have for this ICT professional? Have students prepare their questions and capture them in the way that works best for the group.

Main Activity

Time:	60 minutes
Purpose:	Youth hear ICT professional's perspective on engaging with users.
Materials	ICT Professional and any audio-visual equipment required (computer, LCD projector, overhead, etc.)

To Do

1. ICT professional shares career and engages in an activity with the youth that demonstrates how they engage with users to define the problem and begin brainstorming. The ICT professional may also talk about user testing - and describe how to obtain feedback from users on a design.

Gender Tips

Be sure to prep ICT professional around gendered language, stereotypes, etc. so that they share examples of both genders and a variety of races, working in ICT.

Discussion/Reflection

Time:	10 minutes
Purpose:	Youth ask ICT professional questions they have about the Design Process and how to get input from users.
Materials	None

To Do

1. Ask youth to reflect on the different ways to engage with users.
2. Allow the youth a few minutes to ask the ICT Professional any questions they have, either about their career or about the Design Process.
3. Thank the ICT professional for their time.



Gender Tips

Encourage girls and boys to ask questions of the guest speaker. For youth who are less willing, you may want to give them time before the ICT professional arrives to brainstorm some questions. You can also use the *think-pair-share* technique: give youth a minute to *think* of some questions individually, then ask them to share with partners (*pair*), and finally, ask again if there are any questions for the ICT professional (*share*).

Week 6: The Perfect Hangout: The Design Process

Summary

Schedule

Warm-Up	Define the problem by interviewing users.	35 min
Challenge	Use brainstorming and sketching, create storyboards.	35 min
Main Activity	Research designs by obtaining feedback from users. Develop designs by using storyboards.	60 min
Discussion/Reflection	Check in with each group.	10 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Review Design Process concepts, including that the Design Process is not linear.
- Focus on understanding users' needs and design iteration.

Materials

- Design Notebooks
- Design Process Poster
- Pens or colored pencils
- Paper
- Storyboard templates

Getting Ready

Overview

The main focus for this week is to help youth make progress using the Design Process to develop designs. It will become apparent that the Design Process is not completely sequential. As youth get feedback from their users, they'll need to iterate their designs. They will return to steps in the Design Process, skip over some and repeat others until they have a design that works.

As you go around to the different groups, make note of the direction of their designs in preparation for Week 7 when you will interject a request from new users that contradicts one of the group's major design tenets. For example, a design may have lots of open space for dancing at the request of the users. The new users want a cozy space with lots of comfortable furniture and books. The youth will need to reconcile these two requests. If you are noting each group's design focus during this week (Week 6), you'll be able to make a suggestion to each group for what the new user request might specifically be in Week 7.

Glossary

No new terms.

 **Warm-Up**

Time:	35 minutes
Purpose:	Youth interview users.
Materials	<i>Design Notebooks</i> with questions for users

To Do

1. Ask youth to return to their pairs.
2. Make sure youth have their questions from Week 5 to ask their users. Also, encourage youth to try approaches they learned from the ICT professional or other ideas they have for finding out the needs of the user.
3. Remind youth that they need to identify the problem that the user has beyond the need for a hangout. What do the users need from their hangout?
4. Encourage youth to come up with a way to organize the information they collect from their users.
5. Give each pair 15 minutes to interview their users. One half of the group will be interviewing the other half. Call time, and give another 15 minutes for the other half of the group to conduct their interviews. You can use a round robin approach or have pairs of youth matched to another pair of youth (i.e., the pair interviewing is also the interviewee's users). Do whatever will work best for the youth. Pairs will work well for an even number of students while a round robin approach works well for an odd number.

 **Gender Tips**

In co-ed settings, encourage boys and girls to design for each other. Depending on the personalities in the room, decide if it's better to have an all girl pair design for an all boy pair or have co-ed pairs design for co-ed pairs.

 **Challenge**

Time:	35 minutes
Purpose:	Brainstorm and sketch ideas (based on user interviews).
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Pens and colored pencils• Storyboard templates• Paper

To Do

1. Youth brainstorm in pairs. Remind youth that the idea is to get as many ideas written down as they can. Encourage lots of sketching.
2. Ask youth to think about how to represent the experience of the users who will use the room. Storyboards are a possible tool. Encourage youth to choose some representation that will help them build their model and provide information about how the room will be used. Whatever method the youth choose should clearly describe the room to their users.
3. Make storyboard templates available, but don't make youth feel that they have to use them.
4. Let youth know that next time they will be showing their preliminary ideas to their users to get feedback.

 **Gender Tips**

Maintain conversations and designs focused on form and function, and away from stereotypes of the gender of the user.

Main Activity

Time:	60 minutes
Purpose:	Designers share storyboards with users and obtain feedback on the designs Youth iterate on designs.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Storyboard templates• Pens and colored pencils• Paper

To Do

First 5 minutes

1. Provide youth with tips on how to give constructive feedback. Tell youth to use statements, such as “I like [XX] because [it relates to a need]. “I would change [XX] because we need [...]”.
2. Have designers thank users for their feedback.

Next 15 minutes

3. First group presents their designs and asks for feedback from users.



Gender Tips

Keep working on the gender dynamics of pairs and the interactions between the designer and the new user pairs.

Next 15 minutes

4. Second group presents their designs and asks for feedback from users.

Last 25 minutes

5. Youth refine their designs.

 **Discussion/Reflection**

Time:	10 minutes
Purpose:	Youth discuss and ask questions on Design Process
Materials	Design Process Poster

To Do

1. Ask all youth how their designs are coming along.
2. Check in with each group individually to make sure they are on track. Youth should have their design ideas captured in their *Design Notebooks* and be ready to start building their model room in Week 7.
3. Ask youth the following:
 - How did you use brainstorming in developing your designs?
 - How did you use sketching in developing your designs?
 - Why do you think designers use brainstorming and sketching?
 - What did you research for your designs?
 - How did you use storyboards?
 - Why do you think designers use storyboards?
 - Show me the parts of the Design Process you've done.
 - What parts of the Design Process are easy? What parts are more difficult? Why?

Week 7: The Perfect Hangout: New Users' Need

Summary

Schedule

Warm-Up	Iterate designs to incorporate the needs of more users.	30 min
Challenge	Build a model room. Refer to Checklist for the Perfect Hangout	40 min
Main Activity	Iterate designs during ICT professional's visit.	60 min
Discussion/Reflection	Check in on understanding of the Design Process.	10 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Review Design Process concepts, including that the Design Process is not linear.
- Focus on understanding users' needs and design iteration.

Materials

- Design Process Poster
- Pens or colored pencils
- Paper
- Samples of fabric
- Cardboard sheet or other solid base on which youth can build their model rooms
- Any audiovisual equipment the ICT professional needs (computer, LCD
- Design Notebooks
- Colored clay
- Activity Sheet Checklist for the Perfect Hangout
- Magazines with related images that youth will find interesting
- Any other materials youth will want to work with. (The trick is to find enough interesting materials without

projector, overhead, etc.)

overwhelming the youth with too many options.)

Note: Check with the manager of your middle school program to coordinate the ICT professional's visit.

Getting Ready

Overview

During Week 7, you'll introduce the new users' needs. You might write on a slip of paper for each pair this specific new request that contradicts one aspect of their design. You'll need to refer to what you know about each pair's design. The idea is that design is a series of compromises. Users generally do not agree, so the designer needs to make a compromise that will satisfy most users.

Youth will also start building models of their rooms. You'll want to remind youth to refer to the checklist again as they prepare to present their designs to users and others at Family Tech Night.

Glossary

No new terms.

 Warm-Up

Time:	30 minutes
Purpose:	Designers consider new users' need.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Pens• Design materials youth have created

To Do

1. Tell youth that some new users, friends of the users they've been working with, have heard about the hangout that they are creating and are excited to use the room too.
2. These new users have a new request. Their request is a high priority and must be incorporated into the design.
3. Ask youth to define the word "incorporated". Make sure they understand that a request to be incorporated is not an add-on or something to be ignored, but a feature that must be integrated into their existing design.
4. Provide youth with an example, such as "Your design may have lots of open space for dancing at the request of the users; these new users want a cozy space with lots of comfortable furniture and books." The youth will need to reconcile these two requests.
5. Distribute the new users' request on a slip of paper to each pair.
6. Once youth have read what the users want, let youth know that finding contradictions in what users want is typical for designers. Design is a series of compromises. Users generally do not agree, so the designer needs to make a decision that will make all users happy.
7. Tell youth to make modifications to their designs to incorporate this feedback from users.
8. Let youth know that it's better to learn about this need now rather than after they have started building their model hangout—which comes next! Designers also watch out for the point when it is easy and cheap to make changes: Before you build anything!

 **Challenge**

Time:	40 minutes
Purpose:	Youth construct model of hangout based on their designs.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Checklist• Pens or colored pencils• Paper• Colored clay• Samples of fabric• Cardboard sheet or other solid base on which youth can build their model rooms• Magazines with related images that youth will find interesting• Any other materials youth will want to work with. (The trick is to find enough interesting materials without overwhelming the youth with too many options.)

To Do

1. Tell youth that 3D models are often helpful for presenting physical spaces in addition to the descriptions and explanations of use that they've already created.
2. Introduce them to the materials.
3. Remind them of the relevant points on the Checklist, such as relationship of objects and size.
4. Support youth in building their model hangouts.

 **Main Activity**

Time:	60 minutes
Purpose:	ICT professional shares career and their approach to iteration.
Materials	Any audiovisual equipment the ICT Professional needs (computer, LCD projector, overhead, etc.)

To Do

1. ICT professional shares their career and engages in an activity with the youth that demonstrates how they design and iterate on those designs in order to incorporate feedback from users and other information.
2. Be sure to talk with the ICT professional about the activity they plan to do with the youth to make sure it is age appropriate. Example activities include marking up a web page together and redesigning the structure of a mobile phone.

 **Discussion/Reflection**

Time:	10 minutes
Purpose:	Youth have time to ask ICT professional any questions. Youth can ask questions about the Design Process.
Materials	Design Process Poster

To Do

1. Allow the youth a few minutes to ask the ICT Professional any questions they have, either about their career or about the Design Process.
2. Check in with each group individually to make sure it is on track for completing a model room. Youth should have some parts of their models built by the end of Week 7. Ideally, they should be halfway finished. They'll have time to finish up and create their presentation in Week 8.
3. Ask youth: Show me what parts of the Design Process you've done. What parts of the Design Process are easy? What parts are more difficult? Why?
4. Thank the ICT professional for their time.

Week 8: The Perfect Hangout: Performance Task

Summary

Schedule

Warm-Up	Check in to see that everyone has materials.	10 min
Challenge	Complete building a model room. Use Checklist for the Perfect Hangout. Prepare presentations.	60 min
Main Activity	Give presentations. Checklist and give feedback.	60 min
Discussion/Reflection	Reflect on the Design Process and The Perfect Hangout presentations.	10 min
Total Time		2 hr 20 min

Essential Questions

- Where do you see design around you?
- What is the Design Process?

Design Process Concepts Involved

- Review Design Process concepts, including that the Design Process is not linear.
- Focus on understanding users' needs and design iteration.

Materials

- *Design Notebooks*
- Design Process Poster
- Checklist for the Perfect Hangout
- Pens or colored pencils
- Paper
- Cardboard sheet or other solid base on which youth can build their model rooms
- Magazines with related images that youth will find interesting
- Any other materials youth will want to work

- Colored clay
 - Samples of fabric
 - Technology: If youth want to put their presentations in PowerPoint or some other software program, encourage them to do so.
- with. (The trick is to find enough interesting materials without overwhelming the youth with too many options.)

Getting Ready

Overview

In this Performance Task, youth demonstrate in their presentations as well as their designs and models what they have learned about the Design Process, iteration, and incorporating users' needs. The presentations can be practice for the Family Tech Night.

Since they will have time in Week 9, youth could use the Checklist feedback to refine their designs or presentations.

Glossary

No new terms.

Warm-Up

Time:	10 minutes
Purpose:	Check in about materials. Remind youth about preparing presentations.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Checklist• Pens or colored pencils• Paper• Colored clay• Samples of fabric• Cardboard sheet or other solid base on which youth can build their model rooms• Magazines with related images that youth will find interesting• Any other materials youth will want to work with. (The trick is to find enough interesting materials without overwhelming the youth with too many options.)• Technology: If youth want to put their presentations in PowerPoint or some other software program, encourage them to do so.

To Do

1. Let youth know that today they'll finish up their models and prepare to present their designs and models to the whole group in the next session.
2. Walk through the Checklist with the youth and tell them to use it in deciding how to put their presentations together.
3. Let youth know what resources are available for their presentations, such as laptop, PowerPoint, and overhead, if available.

 **Challenge**

Time:	60 minutes
Purpose:	Finish models and prepare presentations.
Materials	<ul style="list-style-type: none">• <i>Design Notebooks</i>• Checklist• Pens or colored pencils• Paper• Colored clay• Samples of fabric• Cardboard sheet or other solid base on which youth can build their model rooms• Magazines with related images that youth will find interesting• Any other materials youth will want to work with. (The trick is to find enough interesting materials without overwhelming the youth with too many options.)• Technology: If youth want to put their presentations in PowerPoint or some other software program, encourage them to do so.

To Do

1. Youth should finish their models in the first 30 to 40 minutes.
2. Make sure that each pair has a copy of the Checklist and that youth go through it to prepare their presentations.
3. Youth should spend at least 20 minutes preparing for how they will present their designs to the group.

 **Main Activity**

Time:	60 minutes
Purpose:	Review presentations.
Materials	<ul style="list-style-type: none">• Youths' designs• Checklists• Presentation materials

To Do

1. Each presenting pair should be matched with another pair that will use the Checklist to give the presenting pair feedback on their designs and presentation. The pair giving the feedback does not need to be the users of the pair presenting, but can be. The pairs should be matched up so that after the presentations, they can discuss the Checklist.
2. Instruct youth using the Checklist to check off what they see in the presentation and write any explanatory notes that would help the pair to improve their designs and presentation.
3. Youth present their designs and hangout room model.
4. Make time for Checklist discussions pair to pair.
5. Collect annotated Checklists.

 **Gender Tips**

As youth practice their presentations, make sure all have a voice in the presentations.

 **Discussion/Reflection**

Time:	10 minutes
Purpose:	Reflect on the Design Process and The Perfect Hangout presentations.
Materials	Design Process Poster

To Do

1. Ask youth:

- How did your presentations go? Is there anything you would do differently?
- Now that you have a model of your room, what would be the next step in the Design Process if you were to implement your model?

Weeks 9 & 10: Family Tech Night (FTN)

Summary

Schedule

Warm-Up	Youth brainstorm projects and examples they want to share for FTN (Family Tech Night)	20 min
Main Activity	Youth complete project and develop presentations.	80 min
Discussion/Reflection	Youth discuss enduring understandings and reflect on what they've learned.	10 min
FTN Presentations	Youth and leaders host FTN, which may extend into the evening to accommodate adults' schedules.	2 hrs
Total Time		4 hrs

Materials

- Markers
- Display boards
- Posters
- Rulers
- Pencils
- Computers
- Cameras
- Extension cords
- The work youth completed during the unit
- Food
- Utensils
- Plates
- Dry-erase board
- Paper (white/color)
- Note cards
- Scissors
- Tape

Getting Ready

Overview

This is a chance for the youth to showcase to their family, peers, staff, and school community the work that they completed during the unit.

Background

Refer back to the unit's lessons. Family Tech Night gives youth a chance to revisit lessons completed throughout the unit and use the information they learned when presenting their projects to people coming to Family Tech Night.

Tips

- Gather students' projects to give you an idea of what is complete and what needs to be finished from the unit in order to display them for FTN.
- Make sure the youth take a leadership role in the planning and the night itself. (Example: Have youth lead a short lesson with their guests and families.)
- Make the night creative, interactive and fun for the youth.
- Secure a space for FTN that will accommodate the displays and guests.
- If you plan for it, check that the Internet access and computers are working. Also have a backup low-tech version in case the technology does not work or is slow.

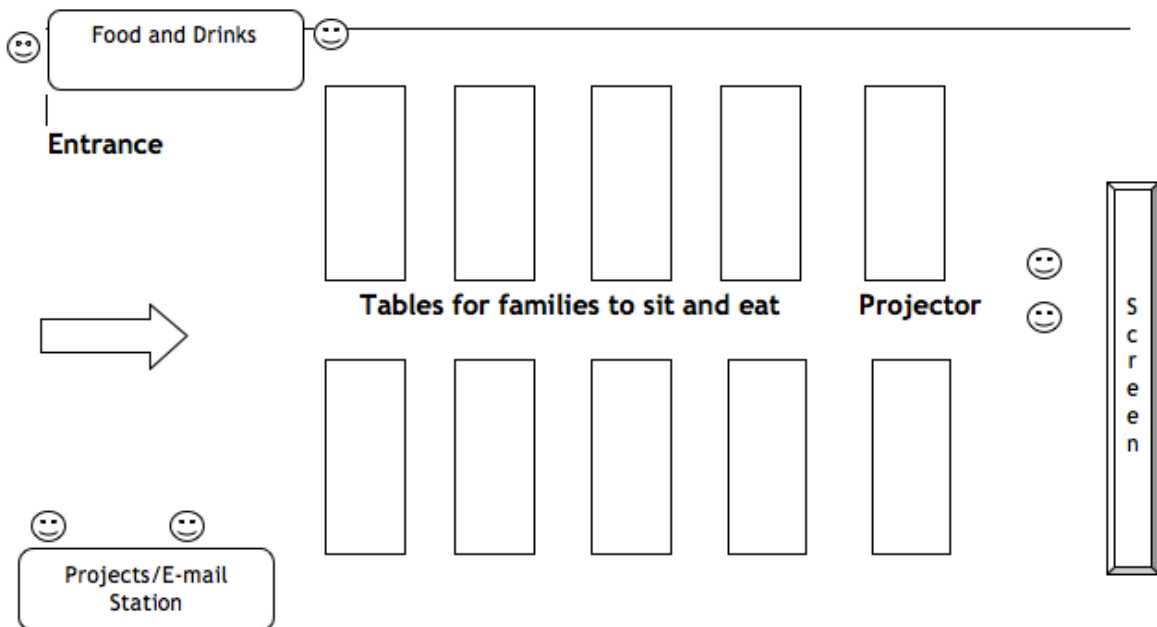
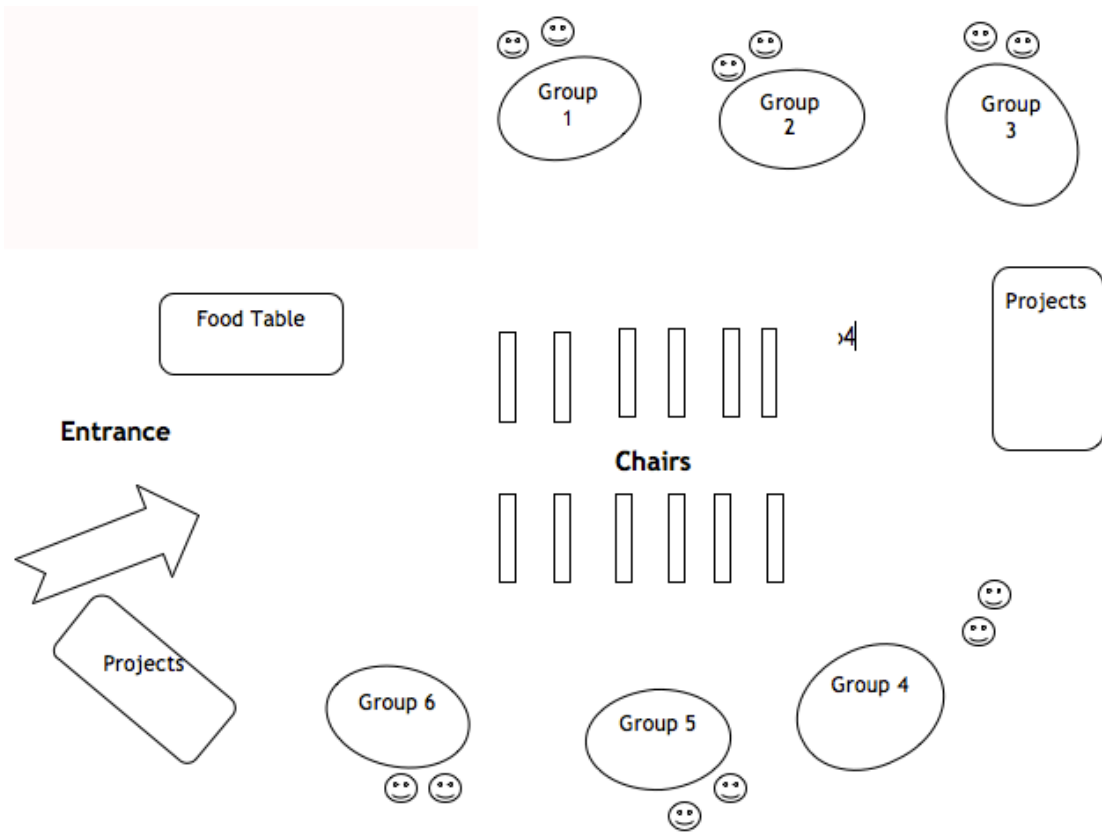
Examples for Unit 1. Dream Machines, Storyboards, Flying Things, and Perfect Hangout are some of the best to show.

Choice 1. Since the Perfect Hangout is the largest project, it can be the main project shown. Other projects, which may need little or no explanation can be displayed and placed on a table (this way, youth know that all work during ICT4me is important). See sample layout.

Choice 2. All projects from Unit 1 can be displayed at different stations. Have youth prepare presentations for each station. Assign youth to each station and ask them to be prepared to discuss the project and their use of the Design Process.

Sample Room Layouts

The layout can vary depending on the number of youth in your class. If you have youth who are not assigned to a group, they can be at the project tables.



Warm-Up: Brainstorming a Plan for FTN

Time:	20 minutes
Purpose:	Brainstorm projects that will be presented to parents/guardians/school staff on Family Tech Night.
Materials	<ul style="list-style-type: none">• Large paper and markers• Dry-erase board and markers

To Do

Before meeting with the students, staff should have an idea of what projects they want to show.

1. Have youth come together in a large circle to brainstorm. A student or facilitator can be the scribe.
2. Have youth think of the projects they want to show. Write down each one and tally how many times each one is stated
3. After a list is created, youth will then choose what they want to work on in small groups. Make sure that each student has a task to complete.
4. You can also focus on one project to show and use this time to brainstorm tasks that need to be assigned to youth to be completed for the event. Make sure to emphasize to the youth that they will show this project to their family so they know the level of work you are expecting.

Tips

- Keep in mind that you are facilitating the brainstorming session and you should already have some options youth can choose from.
- Although only one project is highlighted during the night (in this case, the Perfect Hangout), it is important for youth to know that all ICT4me work is important. This is why all work is displayed.
- Ask ICT4me staff to visit those stations that have fewer visitors.
- Remember to have food that the community you serve will enjoy.

Main Activity: Creating a Plan for FTN

Time:	80 minutes
Purpose:	For youth to make and create their displays to show off their projects for Family Tech Night.
Materials	<ul style="list-style-type: none">• Markers• Paper (white/color)• Note cards• Scissors• Pencils• Display boards

To Do

1. Once a list of roles is created, share the list of roles with youth.
2. Assign roles to youth.
3. Youth get in groups to determine what their stations will look like and how they will communicate knowledge of their project.
4. Facilitator works with youth to ensure that their presentations use appropriate language, are well organized, organization, and that their projects reflect the learning from the unit.
5. Allow time for youth to practice their presentations.

Discussion/Reflection

Time:	20 minutes
Purpose:	Youth reflect on what they've learned in the unit.
Materials	Presentations and project materials that will be used at FTN.

To Do

1. Have youth gather in a circle and reflect on what they've learned during the unit.
2. Remind youth of the essential questions and ask them to respond to these questions now that they are at the end of the unit. The students' answers to these questions should be reflected in their presentations at FTN.

Essential questions for Unit 1

- Where do you see design around you?
- What is the Design Process?

Essential questions for Unit 2

- What does the Internet (and Web) look like?
- What is designed on the Internet (and Web)?

FTN Presentations

Time:	2 or more hours
Purpose:	Youth present what they've learned and designed
Materials	<ul style="list-style-type: none">• Presentations and project materials• Computers with Internet access• Food - It's a celebration!

To Do

1. Set up the stations as planned. Make sure each youth has a role and responsibility.
2. Provide food. It's a good idea to have tables for eating separate from the technology.
3. Back up plan if technology is not working. For example, for Unit 2 you may want to have a PowerPoint capture of the youths' blogs and clubhouses so you are not relying on the Internet. Have copies of the PowerPoint on a pen drive or multiple computers.
4. Encourage visitors to circulate. For example, you may want to create an information gathering game that encourages visitors to go to every station and ask the youth questions.
5. Have fun!

Activity Pages

Week 1

- The Design Process

Week 2

- Shoe Design Challenge
- IDEO's Seven Principles of Brainstorming

Week 3

- Storyboard Template (also used in Week 6)
- Storyboard Examples

Week 4

- Websites for Flying Objects
- How Far Does Your Flying Object Fly??

Week 5

- Checklist for the Perfect Hangout (also used in Week 6, 7)

Week 6

- Storyboard Template (also used in Week 3)

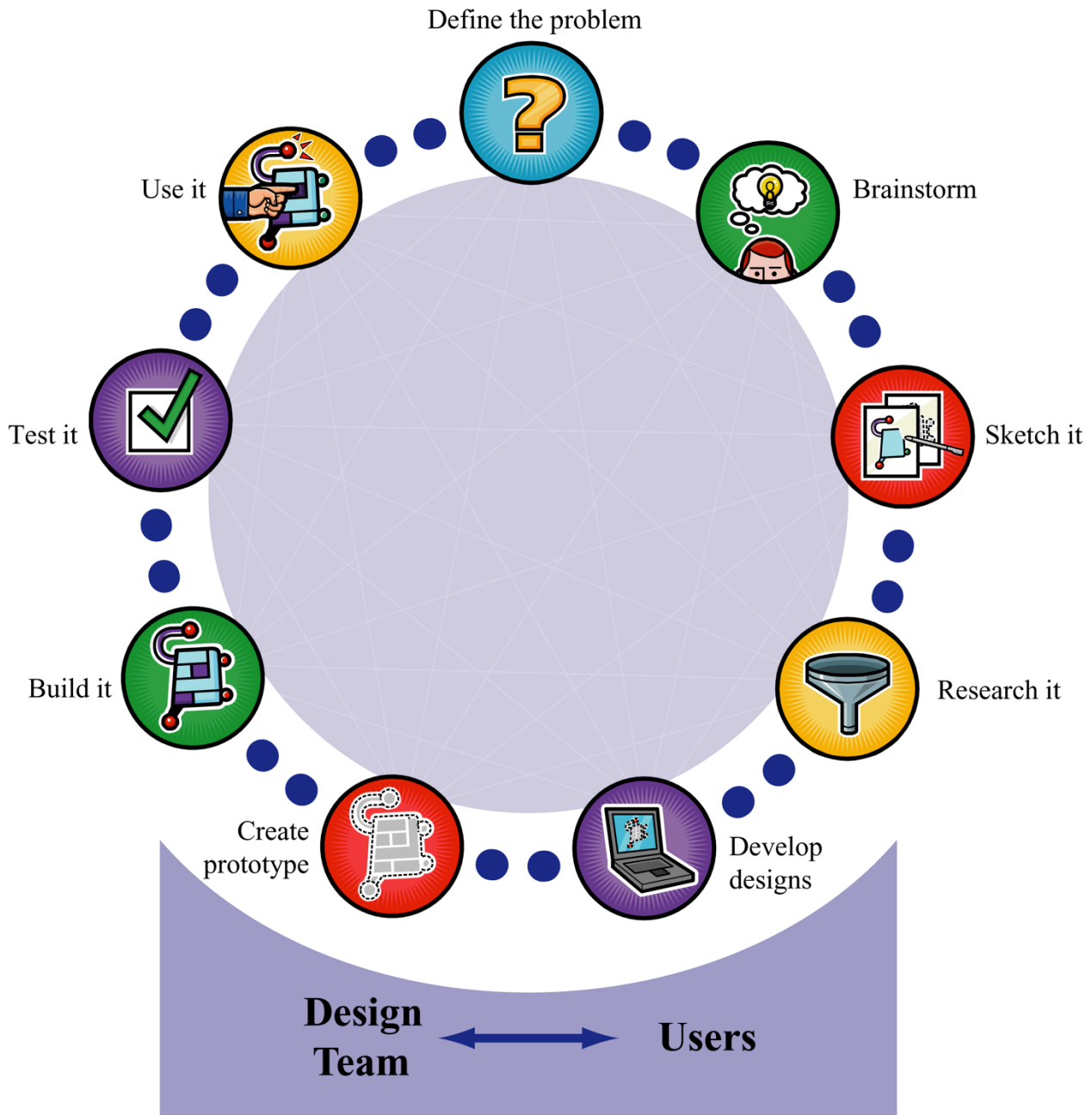
Week 7

- Checklist for the Perfect Hangout (also used in Week 5, 8)

Week 8

- Checklist for the Perfect Hangout (also used in Week 5, 7)

The Design Process



Build IT, a collaboration between SRI International and Girls Incorporated of Alameda County, is supported by the National Science Foundation's Information Technology Experiences for Students and Teachers (ITEST) program under Grant No. ESI-0524762

Shoe Design Challenge

- Identify the user of the shoe.
- Identify the problem that user has.
- Describe how the shoe will address the problem.
- Write down your ideas in your *Design Notebooks*—you will need this information during the next session.
- Draw sketches of how the shoes will look (form) and perform (function).

IDEO's Seven Principles of Brainstorming

- Defer Judgment: no telling your neighbor you don't like their idea
- Encourage Wild Ideas: the crazier, the better
- Build on the Ideas of Others
- Stay Focused on the Topic
- One Conversation at a Time: it's rude to speak while someone else is speaking—plus you might miss hearing a good idea
- Be Visual: sometimes it's easier to express yourself in a picture than with words
- Go for Quantity: you want lots of ideas, and you'll worry about quality later.

Storyboard Template (print large enough for youth to use)

Project Title _____

<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Screen Number _____</p> <p>Screen Sketch</p> <p>Describe the Action</p> <p>_____</p> <p>_____</p> <p>_____</p>

Storyboard Examples

Example 1

Different people can make different storyboards for the same design. See different storyboards for scientific oven mitts, from the MIT Museum.

<http://web.mit.edu/2.744/www/Project/Assignments/conceptSketches/design-omite/storyboard/mitt-story.html>

Example 2

Storyboard of how a software feature works

<http://www.csc.calpoly.edu/~jdalbey/205/Deliver/StoryboardExamples.html#1>

Example 3

Storyboards are also used to tell a story. You can use them to tell how a machine is used by users.

<http://youthlearn.org/activities/using-storyboards-thinking-through-visual-storytelling>

Example 4

Storyboards for how a machine works: “Understanding Your Automobile” examples

http://www.mcli.dist.maricopa.edu/authoring/studio/guidebook/storyboard_example.html

Websites for Flying Objects

Boomerang

History: <http://www.rangs.co.uk/boomhistory.htm>

How it works: <http://www.rangs.co.uk/howaboomworks.htm>

How it is made: <http://inventors.about.com/library/inventors/blboomerang.htm>

Frisbee

History: <http://www.ideafinder.com/history/inventions/story008.htm>

<http://inventors.about.com/library/weekly/aa980218.htm>

How it works: <http://wings.avkids.com/Book/Sports/instructor/frisbee-01.html>

<http://www.montshire.org/minute/mm010902.html>=

How it is made: http://www.enquirer.com/editions/2004/07/20/biz_biz1whamo.html

<http://www.frisbeedisc.com/products/index.html>

<http://www.pet-shop.net/html/frisbee.html>

Aerobie

History: <http://www.aerobie.com/History.htm>

How it works & is made: <http://www.aerobie.com/Science.htm>

How Far Does Your Flying Object Fly??

Every time you throw a flying object, it travels a different distance. One way we can figure out how well *a design* works is by **measuring individual throws** and taking an **average**.

$$\text{AVERAGE} = \frac{\text{Sum of throws}}{\text{Number of throws}}$$

Object 1: _____	How far did it go?
Girl 1 Throw 1	
Girl 2 Throw 2	
Girl 3 Throw 3	
AVERAGE	

Calculate the average here by **adding** the 3 throws and **dividing** by 3

Object 2: _____	How far did it go?
Girl 1 Throw 1	
Girl 2 Throw 2	
Girl 3 Throw 3	
AVERAGE	

Calculate the average here by **adding** the 3 throws and **dividing** by 3

Remember: measure using a common unit, so that you can compare your information with the other teams.

$$\text{AVERAGE} = \frac{\text{Sum of throws}}{\text{Number of throws}}$$

Other teams may have also tested the same object. Write down all the averages for all the objects and calculate a final average (by adding the 2 averages and dividing by 2).

	Name	Average 1	Average 2	Final Average
Object 1				
Object 2				
Object 3				
Object 4				
Object 5				
Object 6				

Now you have more information to help you decide design your own flying object!

Checklist for the Perfect Hangout

Your Design Plan

For the design plan, do the following:

- Communicate your design effectively to users.
- Use materials given, not ones created by the group.
- Identify what each object is.
- Include three types of technology, real or invented, with information on what each technology does.
- Show the borders of the room and how one enters or leaves the room.
- Show how the objects are arranged in space.

Your Presentation

For the presentation, do the following:

- Describe the client's needs and include quotations from the client describing those needs.
- Explain the function of each object in the room.
- Explain why objects are arranged the way they are.
- Describe how the design meets the client's needs and include quotations from the client describing whether or not the design meets those needs.
- Describe how a user might use the room on a typical day.