

# Build IT

## Introduction to Build IT

*Girls Building Information Technology Fluency Through Design*

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## ***Resources Consulted***

The Build IT team has consulted the following resources to develop Units 1-6:

- Techbridge (NSF-HRD 0080386)
- Imagination Place! (NSF-HRD 9714749)
- *The New Way Things Work* (Macaulay, 1998)
- The ACM's report *A Model Curriculum for K-12 Computer Science* (Tucker et al., 2003).
- *CyberSmart's Communication Inventions Activity*. By the CyberSmart Education Company
- *Learn the Net* <http://www.learnthenet.com>
- *Intel's The Journey Inside* <http://www.intel.com/education/journey/>
- Internet Safety National Center for Missing and Exploited Children, <http://www.missingkids.com>.
- New Games Foundation's *New Games Book*, *More New Games*, and *Best New Games*.
- *Introduction to Computing*. Bermuda Information Technology Course Track. (2000) By Stanford University Computer Science Department. Bermuda Computing Curricula Project
- StageCast Creator <http://www.stagecast.com/>. In Unit 5, we are using this game creation software designed for middle and high school students as an introduction to object-oriented programming.
- Tapped In (NSF-REC #0106926) is part of Unit 2.
- Oracle's Think.com is used as blogging software since many schools block other common blogging application sites.

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## Welcome to Build IT

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We invite you to use the Build IT curriculum to inspire middle school girls to not only use information technology, but to design information technologies that solve human problems. Research shows that many girls are turned off by technology because it is presented as a technical marvel rather than a tool to help someone solve a problem. Build IT is a problem-based curriculum that capitalizes on girls' interest in design and communication technologies to show them that they can have fun designing and developing technology tools to address societal problems.

What is information technology? Information technology (IT) or information and communication technology (ICT) is the technology needed to process information. This technology includes both the computer hardware and software to convert, store, protect, process, transmit, and retrieve information from anywhere, anytime. Information can be in many forms: text, numbers, conversations, still images, motion pictures, and multimedia presentations to name a few.

The goals of Build IT are to motivate middle school girls to:

- use technology to strengthen and build their technology fluency,
- take high school algebra and geometry courses in preparation for postsecondary STEM education and IT careers, and
- explore IT and pursue IT careers.

In addition, Build IT aims to enhance staff capacity to offer IT fluency programming.

To achieve these goals, the Build IT curriculum includes activities that:

- teach computer science concepts through design and communication technologies,
- connect computer science topics and mathematics concepts,
- provide structured interactions with IT professionals,
- enable the girls to participate in design teams, and
- embed performance tasks to provide evaluators, teachers, parents, girls, and staff with evidence of girls' learning and opportunities for reflection.

After hearing “we can, but we don’t want to” and “girls have other priorities; guys are more computer-type people,”<sup>1</sup> we want to foster girls’ interests in using and developing technology. After participating in the Build IT program, many of the girls are now expressing interest in IT careers: “I want to be a software engineer because I want to be involved with computers,” and “I would like to create software because I would make a lot of money, and people in these jobs are intelligent.”

Sincerely,  
The Build IT Team

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<sup>1</sup> Excerpts of interviews with middle and high school girls conducted by the Commission on Technology, Gender, and Teacher Education, 2000.

## **Overview of Build IT's Six Curriculum Units**

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The curriculum consists of six units that incorporate problem-solving activities in which the girls critique and critically frame problems, guided practice in which girls participate in a software engineering process, and opportunities to redesign and troubleshoot available technologies. Each activity and unit builds on the previous; however, units and many activities can be used individually.

Program staff guide the activities. Design is used throughout the curriculum to reveal to the girls how technology functions at the user interface, code-base, and system levels, and the relationship of the functionality at each level to individual users' and societal needs.

### **Unit 1: Redesigning Your World (one semester, after school; Apprentice level).**

In this introductory unit for Build IT, girls 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. Girls are introduced to the Design Process, a process that they will use throughout Build IT. In a culminating performance task, girls present their vision for a redesigned object, along with results from their user testing. The unit concludes with girls reflecting on the successes and limits of their designs and the possible effects of designs on social processes. Girls share their designs at Family Tech Night.

### **Unit 2: Design Online: Communication Tools and the Internet (one semester, after school; Apprentice level).**

Girls are introduced to the Web and the Internet as communication tools. They learn about the structure of the Web and the Internet, and explore the design of a variety of communication tools on the Internet. Girls learn to compare online tools to determine the tool that they might use or enhance from an engineering perspective. In teams, the girls explore and design using two tools in depth: blogs and an online community space. The fieldtrips and IT professional visits feature IT professionals who design for the Web. The girls share their designs and reflections at the Family Tech Night.

### **Unit 3: Redesigning the Web (two weeks during the summer; Apprentice level).**

In this summer session, girls work individually and in teams to apply their design skills to the development of web pages and web-based communication tools. Program leaders provide instruction on web development and guided practice in the girl-led problem-based activities. The unit concludes with girls reviewing each other's designs. The girls reflect on the successes and limits of their designs and the impact that not knowing technical limitations and affordances of the Web had on their designs. They share their designs and reflections at Family Tech Night.

**Unit 4: Design in Networked Technologies (one semester, after school; JourneyGirl level).**

Girls participate in activities that feature computer science concepts and networked technologies. In groups, girls develop and test algorithms in regular language and graphics. They use and discuss current networked applications and technologies that use these algorithms and other computer science concepts. They explore the hardware design of networked technologies, including telephones, computers, and PDAs. In design teams, they develop their own activities or games using these computer science concepts. Girls share the activities and games they've designed at Family Tech Night.

**Unit 5: Collaborative Game Design & Troubleshooting (one semester, after school; JourneyGirl level).**

Girls experience the participatory design process as they work in teams to design a game for younger girls in the Girls Inc. program. Girls receive instruction and opportunities to practice leadership skills, and enhance their leadership abilities through practice, as they offer assistance, support, and team leadership. Girls learn how to allocate resources—technological and human—and how to share and distribute knowledge among team members. In addition to developing leadership and collaboration skills, the girls continue to explore computer science concepts in this unit, specifically object-oriented programming. Girls present their projects at Family Tech Night.

**Unit 6: Joining a Design Team (two weeks during the summer; JourneyGirl level).**

Girls work in collaborative teams to apply their design skills to the development of web pages for a specific client. Program leaders (alongside the client, if possible) facilitate web development and guided practice in the girl-led problem-based activities. Girls gain leadership skills by interacting with their client and users, taking the initiative to learn the HTML they need to complete the job, and presenting their web pages to the client. Girls at the JourneyGirl level assist girls at the Apprentice level in the design of their websites. Girls also reflect on the variety of careers they see through field trips to IT organizations. At the Family Tech Night, girls showcase their technology solutions and their IT career experiences.

## **Big Ideas in Build IT**

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Enduring understandings is a term from *Understanding by Design* that refers to the “big ideas” of a discipline that experts know and that are the foundation for building knowledge in the discipline. The enduring understandings or “big ideas” in Build IT draw from the disciplines of computer science and mathematics. The chief standards documents we have drawn on are Being Fluent with Information Technology (NRC), the Secretary’s Commission on Necessary Skills (SCANS), and the National Council of

Teachers of Mathematics (NCTM) standards. We have also drawn from A Model Curriculum for K-12 Computer Science (ACM).

Throughout the Build IT curriculum, these enduring understandings appear as essential questions to be used in discussion and reflection with girls and are part of performance tasks and Family Tech Nights where girls demonstrate what they know and can do. Family Tech Nights are celebrations of girls’ achievements where they present what they’ve learned and designed. Family members, teachers, IT professionals, and other community members are invited to these events.


Performance tasks are activities that occur in the middle and the end of each unit that allow girls to demonstrate to themselves and others how well they understand the concepts highlighted in the enduring understandings. Unlike Family Tech Nights where the focus is on the presentations and celebration, performance tasks give girls an opportunity to apply what they’ve learned in the unit.

The Build IT curriculum includes the following enduring understandings:

**Computer Science Content**

<b>Design</b>	Design is a process with specific stages and elements: brainstorming, planning, gathering user data, scenario development, storyboarding, requirements and documentation, prototyping, user testing, and revising (NRC). An initial solution is often revised or improved by iteration, which often causes a refinement in the definition of the problem (NRC, SCANS). Testing entails determining whether a proposed solution meets design goals (and whether the design addresses the problem) and works under diverse conditions, taking into account that most systems will be used in ways that were not intended, as well as in expected ways (NRC, SCANS).
<b>Computers</b>	All computers are programmed, meaning they follow a sequence of basic steps (NRC). Computers, in a variety of sizes, can be used independent of networks and as part of networks (NRC, SCANS).
<b>Systems and Networks</b>	Information systems include a variety of human and technology components that can be mapped and analyzed to troubleshoot problems and improve the system (NRC, SCANS). Networks have physical and logical structures that allow information to be routed between computers. These structures have an impact on the flow (e.g., bandwidth) of information that can affect a user’s experience (NRC, SCANS).
<b>Trouble-shooting</b>	Technology analogies exist and can help one to become adept at using new technologies and to troubleshoot (NRC). To troubleshoot a problem in an information technology system, application, or operation, it is essential to have some expectation of what the proper behavior should be and how it might fail to be realized (NRC).
<b>Collaboration &amp; Leadership</b>	Collaboration involves a strategy for dividing tasks associated with a solution into pieces that can be worked on individually and reassembling the work products into a cohesive whole to form the solution (NRC, SCANS). Leadership involves teaching others new skills, communicating ideas to justify a position and convince others, and supporting a vision that may challenge the status quo (SCANS).

### Mathematics Content

<b>Problem solving, reasoning, communication and representation.</b>	<p>A “mathematical disposition” toward problem solving requires analyzing given information, drawing on specific strategies, and having the ability to monitor and adjust strategy use.</p> <p>Mathematical reasoning includes making conjectures and using deductive reasoning to prove or disprove them and can be applied to computer science strategies such as troubleshooting algorithms.</p> <p>Mathematical communications and representations involve effective use of diagrams, equations, and other mathematical symbols. Developing the skills to communicate mathematically can make collaborative design work easier and more productive. (NCTM)</p>
<b>Algorithmic Thinking</b> 	<p>Develop a simple understanding of an algorithm, such as text compression, search, or network routing, using computer-free exercises.</p> <p>Understand the fundamental ideas of logic and its usefulness for solving real-world problems.</p> <p>Gain a conceptual understanding of the basic steps in algorithmic problem-solving (problem statement and exploration, examination of sample instances, design, program coding, testing and verification)</p> <p>Design algorithms and programming solutions to a variety of computational problems including variables, data types, and the representation of data in computers (ACM)</p>



## **Design!**

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The Design Process

Purpose of Design Notebooks

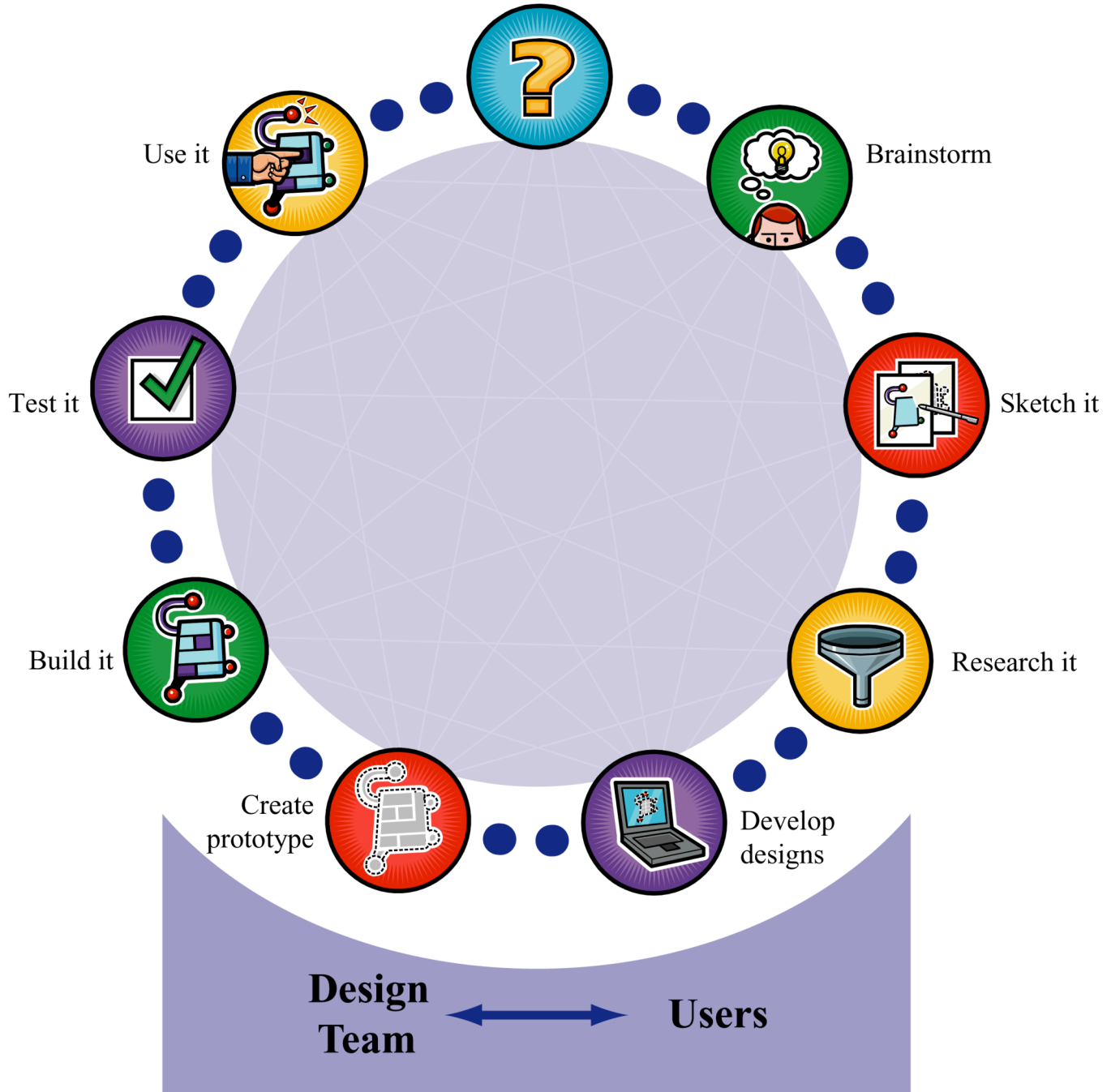
Fostering Technology Design

### **The Design Process**

The process of design is an iterative, interconnected cycle that can involve users at a few or many stages of the process. The following graphic can be enlarged and used as a poster:

# The Design Process

Define the problem



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

## **Purpose of Design Notebooks**

The Design Notebooks are binders with paper and pockets where girls can capture their designs and ideas for designs. Professional designers use notebooks and other tools, often online, to keep track of designs and ideas. The Design Notebooks serve two main purposes in Build IT:

- to reinforce for girls that they are designers; their designs are important and worth keeping, and
- to provide summative pictures and text of what happened in the unit. Program leaders may decide to use these at Family Tech Night.

## **Fostering Technology Design**

- Give participants plenty of time to tinker. Encourage them to experiment, to try things.
  - Fill the room with tools, gadgets, machines (working and nonworking), pieces, parts, materials, nuts and bolts, found objects. Also, to the extent possible, make "building" materials available (e.g., Tinker Toys, Erector sets, Lego). Encourage your participants to use these items to build things, to try out ideas, to "tinker"—an age-old pleasure too often reserved for boys and men.
  - Whenever possible, encourage participants to take things apart—a clock, a toy, a broken typewriter, computer, anything!
  - Find examples of design wherever you can and share them with your participants. Invite them to do the same. Bring in something you love just for its design. Cover the walls with examples of graphic design, with pictures of "designed" things—everything ranging from clothes to houses to hairstyles to cars to computers to mobile phones. Have girls contribute to these collections.
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## Tips for Recruiting and Hosting IT Professional

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IT professionals are an important and integral part of the Build IT curriculum. Below is an overview of how and where to recruit professionals and tips for engaging with the IT professional before, during, and after the session she attends. In addition, each unit includes a summary of the types of IT professionals to contact.

### Recruiting Tips

Finding IT professionals requires networking with the IT industry. Don't worry; you probably already have connections! First, make a list of local organizations that you know develop software, hardware, networks, and/or Internet-based products. Take a look at your funder and board member lists. Think globally as well. You might be surprised how many large organizations such as Intel, Adobe, or Google may have local offices near you.

The best contact is someone you know at one of these organizations. Check with your colleagues for whom they know. The human resource departments at these organizations can also be very helpful. They often already have a format for offering field trips. An introductory email followed up by a phone call usually has a positive result. Most companies are eager to give back to the community and find IT visits and field trips a relatively painless way to do so.

### Hosting Tips

#### ***Before the activity.***

##### 1 month or more:

Schedule the IT professional.

Send them an IT Professional Packet, either the field trip or site visit version depending on the situation.

Make sure you have the IT professional's contact information, including phone and email.

##### 1 week:

Confirm the time and location with the IT professional.

Go over the activity with them. See if they have any concerns or questions.

Give them an overview of what to expect from the girls.

Confirm the types of materials and technology that you'll need to have available.

##### 1 day:

Make sure all materials and technology are available.

Review the basic Build IT activity for that day and any notes you have from your conversations with the IT professional. They may alter the activity slightly so that it meshes with their perspective on design and technology development.

***During the activity.***

Introduce the IT Professional.

Co-lead the activity with the IT professional. How much you need to lead will vary by individual.

***After the activity.***

Send the IT professional a thank you note from you and the girls. Send it via email!

Invite the IT professional to your Family Tech Nights.

**IT Professionals Packet**

See the IT Professional Visit Packet and the IT Professional Field Trip Packet for the information to share with IT professionals to prepare for engaging with the girls.