

Designing for Design Learning

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ABSTRACT

This paper highlights the need for a science of design to address the needs of technology design learners. For educational technology developers who focus on science of design learning there is an intersection between (1) the curriculum and technology design methodologies they may use to create the learning materials and (2) the design concepts and methodologies they intend to teach in the learning materials. The developers of the NSF-funded Build IT program are experiencing this intersection first-hand as they create and research a technology-supported curriculum that teaches technology design skills and concepts to middle school girls. The Build IT developers would welcome feedback from the CHI community on their design approach and design learning content. The developers can also share with the CHI community what they are learning about the intersection between how they create the materials and the design learning content.

Author Keywords

learner-centered design, user-center design, participatory design

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

The need for a ‘science of design’ goes beyond technology professionals: it must also reach today’s learners. To address the national shortage of information technology professionals, we must attract more youth to the IT field, specifically women and minorities. A focus on design meets two important needs: Attract youth to the field of information technology and provide learning opportunities and entrees into information technology and computer science fields [3]. Furthermore, according to leading national engineering organizations every technologically literate person must have an understanding of the design process. [4,5,6,7].

The questions are: Can we distill a science of design for technology design learners? And if we can, how can educational technology and technology-supported curriculum developers teach design concepts and methodologies well?

It is interesting to note that for educational technology and curriculum developers, there is an intersection between (1) the curriculum and technology design methodologies they may use (e.g. user-centered design, participatory design, learner-centered design) to create the learning materials and (2) the design concepts and methodologies they intend to teach in the learning materials. The developers of the NSF-funded Build IT program are experiencing this intersection first-hand as they create and research a technology-supported curriculum that teaches technology design skills and concepts, as they are defined by engineering and technology fluency policy [5,6,7]. Build IT developers use user-centered design, participatory design, and Understanding by Design (UbD) [8] methodologies to create the curriculum. The developers would welcome feedback from the CHI community on their design approach and design learning content. The developers can share with the CHI community what they are learning about the intersection between how they create the materials and the design learning content.

THE BUILD IT PROGRAM AND DESIGN

Build IT development partners, SRI International (SRI) and Girls Incorporated of Alameda County (Girls Inc.), are collaborating to develop and implement a design-based curriculum that promotes middle school girls’ information technology (IT) fluency and incorporates the STEM content of mathematics and computer science.

In Build IT, an after school and two-week summer program, middle school girls explore and tinker with existing information technologies (e.g. web-based tools, collaboration tools, wireless and mobile devices) and create some of their own information technologies using simple programming tools. Throughout Build IT, girls use The Design Process (see Figure 1) and experience user-centered and participatory design methodologies on a variety of information technology development projects [1,2].

The developers of Build IT start with a design methodology, UbD, to develop the technology-supported curriculum. Several of the articulated learning goals—the first step in UbD—are specific design skills and concepts from computer science. For example, girls learn concepts such as ‘designs have both form and function’ and that ‘design is a process.’ They also learn specific design skills such as defining the problem, user testing, and how to

iterate. Embedding design learning and design methodologies throughout the curriculum is key to achieving the overarching goals for the Build IT program. These programmatic goals are to motivate middle school girls to use technology, achieve technology fluency and increase their interest in IT careers.

In addition to the learning goals for the girls, the program also seeks to enhance the Girls Inc. staff's capacity to provide IT fluency programming. While SRI leads the UbD approach, the Girls Inc. staff is experiencing both user-centered and participatory design approaches in working with SRI to develop the tech-supported curriculum. Early in the development process, the SRI team learned that the staff, even though they were nervous about using many of the technologies, had more to learn about design than the technologies. Creating the curriculum together using all of these methodologies illuminates for the staff the process of design enabling them to incorporate important language, tips and strategies into the curriculum for future implementations at this Girls Inc. site and at Girls Inc.'s 1500 affiliate locations.

Achieving Technology Fluency: What Are Girls Learning about Design?

The summative and formative evaluations of Build IT's first year (Units 1, 2, and 3) [1,2] show that the 76 girls who participated in Build IT are learning design and technology skills but conceptual understanding of design and information technology concepts were not understood by the majority of these girls. In the second year of the project, the development team made changes to the curriculum to make the design learning goals more explicit to the youth leaders and the girls. The curriculum also provides time for the youth to reflect on these concepts; while the professional development for the youth leaders provides time for them to reflect on these concepts at an adult level.

Is Design Attracting Girls to IT Careers?

The Build IT first year evaluations also show that girls' images of IT careers as solitary and boring are changing significantly to collaborative, fun, and intellectually stimulating. This change in perception is in stark contrast to pre-test data and girls' general impressions of IT careers as solitary, boring, and repetitive. The year two evaluations seek to understand the elements of the Build IT program that lead to this change. Design activities and the interactions with IT professionals who share their design methodologies are two elements that researchers are investigating.

CONCLUSION

Build IT uses design to both entice and teach girls information technology and computer science concepts. Within the technology-infused curriculum, there are technology fluency performance tasks that enable the girls to demonstrate what they are learning to their peers, youth

leaders, parents, teachers, and the larger community. Design methodologies (UbD, user-center design, participatory design) are also playing a critical role in the development of the curriculum and the capacity building of the Girls Inc. staff to provide the curriculum. This intersection of design—designing a curriculum and technologies to teach design and the content of design learning—needs further research to understand how best to teach design, especially to middle and high school students and their teachers who may have limited experience with design concepts and methodologies.

The CHI community could offer valuable feedback on Build IT team's efforts to distill design concepts and methodologies. For example, the design process, which is much more complicated than Figure 1 depicts, shows the choices that the developers made to teach this complicated process to middle school youth. Likewise, user-centered design and participatory design have many elements that may confuse youth rather than encourage their learning. Here too, developers have made choices that would benefit from feedback from the CHI community.

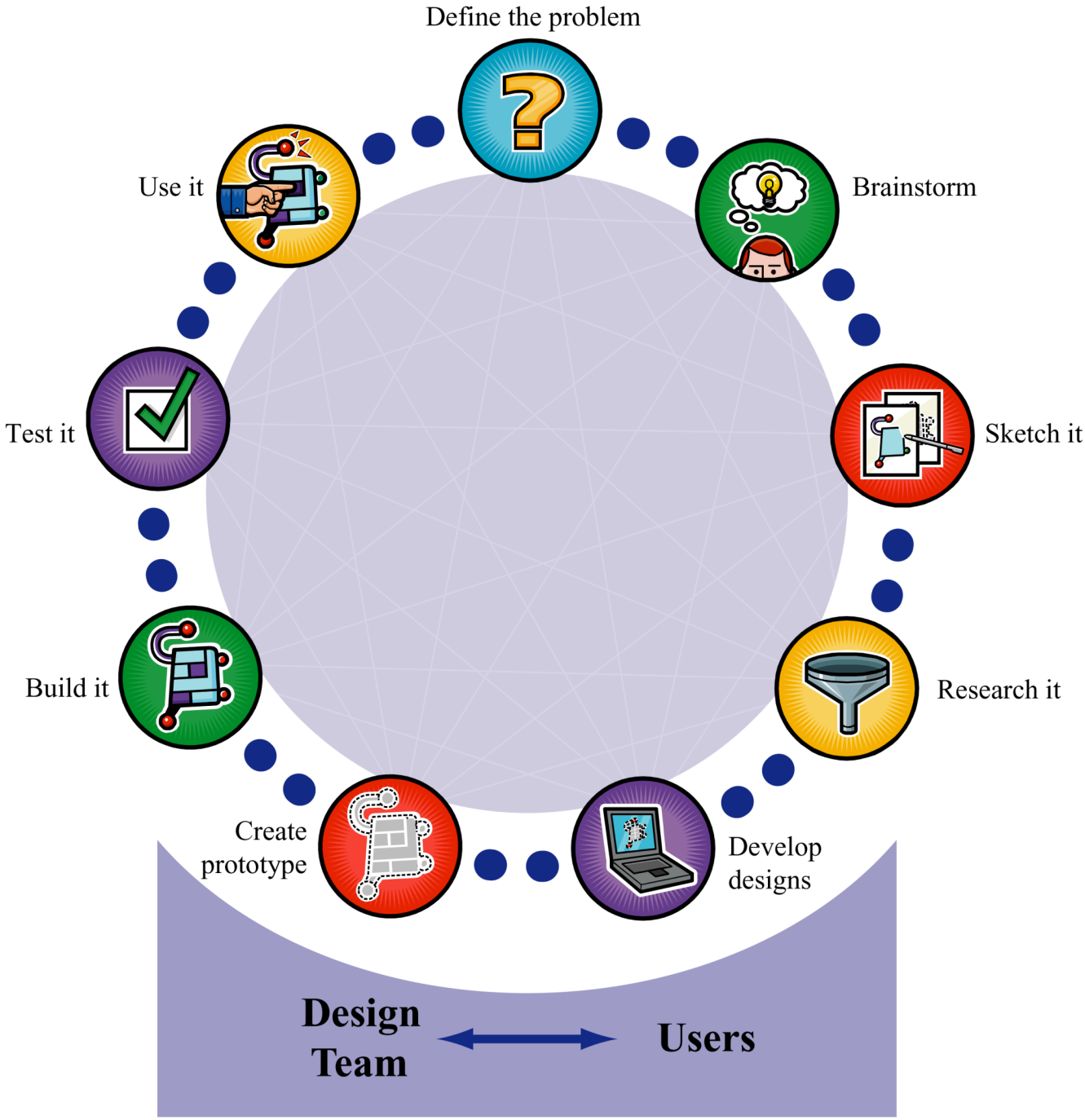
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The Design Process



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

Figure 1. The Design Process poster used in the Build IT curriculum.