

CHI Conference Publications Form

Shelly Goldman

School of Education Stanford University
485 Lasuen Mall
Stanford, CA 94305 USA
650 723 2109
sgoldman@stanford.edu

Maureen Carroll

Hasso Plattner Institute of Design at Stanford
451 Panama Mall
Stanford, CA 94305 USA
925 963-8596
carrollm@stanford.edu

ABSTRACT

The purpose of the Taking Design Thinking to Schools Research Project was to extend the knowledge base that contributes to an improved understanding of the role of design thinking in K-12 classrooms. The ethnographic qualitative study focused on the implementation of an interdisciplinary design curriculum by a team of university instructors in a public charter school. Three questions framed the study:

- How did students express their understanding of design thinking classroom activities?
- How did affective elements impact design thinking in the classroom environment?
- How is design thinking connected to academic standards and content learning in the classroom?

Keywords

Human-centered design, ethnography, Multidisciplinary/ Interdisciplinary design

INTRODUCTION

Design Thinking is an approach to learning that focuses on developing students' creative confidence. Students engage in hands-on design challenges that focus on developing empathy, promoting a bias toward action, encouraging ideation, developing metacognitive awareness and fostering active problem solving. Using one's imagination is central. Design Thinking provides a powerful tool that supports creativity and innovation. According to The Partnership for 21st Century Skills, the central economic competitiveness issue for the Obama administration is to create an aligned, 21st century public education system that prepares students, workers and citizens to triumph in the global skills race. A focus on innovation, creativity, critical thinking, problem solving, communication and collaboration is essential to prepare students for the future. Diversity of perspectives and ideas is essential for innovation (Staw, 2006). This research study introduced middle school students to Design Thinking.

Much of today's education system guides students toward finding the correct answers to fill-in-the blanks on standardized tests, as this kind of instruction facilitates streamlined assessments to measure success or failure. Design Thinking provides a powerful alternative to this model by challenging students to find nuanced answers to complex and difficult problems that have multiple viable solutions and by fostering students' ability to act as change agents.

THEORETICAL PERSPECTIVE

The project was guided by a theoretical rationale that is based on a sociocognitive view of learning. As Vygotsky (1934, 1978) described, opportunities to interact verbally with others in a social environment become crucial to cognitive development. The key components of design process are that it is (1) human-centered (2) action-oriented, and (3) mindful of process. (Hasso Plattner Institute of Design, 2007). Through meaningful, hands-on projects, students develop deep understanding of a domain while developing skills in building empathy with users, collaboration, and prototyping. Promise for this work has been shown in several projects (Goldman, 2002; Hmelo, Holton & Kolodner, 2000). Kafai & Resnick (2002) and Todd (1999) suggest that design thinking skills are not merely extras, but can in fact aide students in core subject areas as well as building cognitive and social skills. Vande Zande (2007) characterizes design thinking as a means of creative problem-solving that relates thought and action directly and dynamically. Design has the potential to impact learning skills such as working in groups, following a process, defining problems, and creating solutions (Barron, 2006).

FINDINGS

Three key themes emerged from the research:

- Design as Exploring: Understanding Design
- Design as Connecting: Affect & Design
- Design as Intersecting: Design Thinking & Content Learning

The first theme, Design as Exploring, highlighted the ways in which students participated in the classroom design activities. Students embraced diverse aspects of the design thinking process, adopted the discourse of design in varied ways, and were able to reflect on the nature of the process

as they created a series of prototype-driven projects. Giving students the opportunity to explore as they problem solve is an essential component of learning. Design Thinking does not encourage students to jump to immediate solutions; instead, the focus is on exploring all aspects of problems through multiple sources and iterations.

The second theme, Design as Connecting, forefronted the powerful role that design thinking plays in developing students' creative confidence. Students were engaged in personally meaningful work, had opportunities to express their voices, and saw the power of risk-taking as they engaged in design challenges. Collaborative experiences are a key foundation of Design Thinking. Students had many opportunities to problem solve with each other. They became more empathetic, learned how to work in a group setting with a focused goal, and struggled to figure out how to participate as a seventh-grade student in a collaborative task. In sum, Design Thinking activities provided tools that helped illuminate the complex nature of collaborative efforts, and the multiple ways to develop as a successful collaborator. The third theme, Design as Intersecting, highlighted the relationship between Design Thinking and academic content learning. The integration of design thinking into the classroom learning environment was both challenging and problematic. Instructors, classroom teachers, and students faced many obstacles. The teacher struggled with integrating new knowledge about design thinking with her instructional goals, as she questioned the value of this new way of thinking and its place in her classroom culture. The students had to learn both design thinking concepts and geography content, both of which were new to them, and they also had to make connections between them. Technology was used as a tool to help students express their growing understandings of the design process, as students made videos of their design solutions.

These videos displayed the range of students' learning.

IMPLICATIONS FOR PRACTICE

Design Thinking has an impact on the ways that students engage in the learning process. It challenges them to think in new and creative ways and take risks. Design Thinking and collaboration are intricately linked. The collaborative process in the classroom is impacted by students' willingness to listen to other's ideas, to take risks, and to share their ideas with others. Design Thinking projects thrive in a climate where collaboration is an explicitly valued part of the classroom culture. It also provides a means for students to be cognizant of where they are in the process, and thus encourages metacognitive awareness. Design Thinking activities should focus on how to best foster this awareness through both the design cycle and in assessment of interdisciplinary academic content learning.

IMPLICATIONS FOR RESEARCH

The following research questions arose from this study:

- How can we develop classroom cultures that invite risk taking, openness collaboration and innovation?
- How can technology be more effectively used as a tool to express students' understanding of the design process?

- What are the best practices for integrating Design Thinking into classroom settings?
- How can we more effectively assess what students are learning about design thinking?

CONCLUSION

In this study design thinking became part of the classroom learning environment in diverse ways. Students explored different aspects of They were energized, excited, and challenged by their design tasks as they brainstormed with their peers. The most important learning, perhaps, was that design thinking fosters the ability to imagine without boundaries and constraints. This is critical, as the development of creative confidence is an essential part of learning. Design thinking may help students become empowered agents in their own learning who possess both the tools and the confidence to change the world. As one student in this study stated, "If I set my mind to it I can do it."

REFERENCES

1. Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. *Human development*. Vol 49, No. 4., 193-224.
2. Goldman, S. (2002). Instructional design: Learning through design. In J. Guthrie, (Ed.), *Encyclopedia of Education*. Second Edition. New York: Macmillan Reference USA. 1163-1169.
3. Hasso Plattner Institute of Design at Stanford. (2007). *Design thinking process*. Palo Alto, C.A.: Stanford University.
4. Hmelo, C., Holton, D., & Kolodner, J. (2000). Designing to learn about complex systems. *The Journal of the Learning Sciences*. Vol. 9, No. 3. 247-298.
5. Kafai, Y. & Resnick, M., (Eds.). (2000). *Constructionism in practice: designing, thinking, and learning in a digital world*. Mahwah, New Jersey: Lawrence Erlbaum Associates.
6. Kolodner, J., Gray, J.T., & and Burks Fasse, B. (2000). Promoting transfer through case-based reasoning: rituals and practices in Learning by Design™ Classrooms. *Cognitive Science Quarterly*. Vol. 1.
7. Staw, B. (2006). Individualistic culture trumps teamwork. University of California at Berkeley. www.hass.berkeley.edu/innovation9.html
8. Todd, Ronald. (1999). Design and technology yields a new paradigm for elementary schooling. *Journal of Technology Studies*. Vol. 25, No. 2. 26-33.
9. Vande Zande, R. (2007). Design education as community outreach and interdisciplinary study. *Journal for Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*. Vol. 3: No. 1, Article 4.
10. Vygotsky, L. S. (1976). *Thought and language*. (A. Kozalin, Trans.). Cambridge, MA: MIT Press (Original work published 1934)

