Guiding Critical Technical Practices in Community-Based Maker Spaces for Youth Through Question Prompts

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Abstract
In this study we investigate the use of question prompts as a scaffold for the development of metacognitive thinking in relation to critical technical practices in community-based maker spaces for youth. Using qualitative methods, the study generated a set of eight core questions that self-aware makers should themselves: What will make me happy? Who is my audience? What resources do I have and need? What will inspire me to spend my time and effort? What do I know? Can I let myself make a mistake? How will my creation affect other people? What kind of a maker am I?

1   Introduction

Being "critical in, on or around computing" (Floyd, 2005) begins with self-awareness and a disposition toward self-critique. How might we develop in young people a self-aware stance to making technological artifacts? This poster reports on the "Mindful Making" project, a study that explored dialectic reasoning as a scaffold for the development of metacognitive thinking in community-based maker spaces for youth. We report here on one of the outcomes of the study, a set of eight core questions that adults who facilitate community-based maker spaces can use in conversations with teen "makers" to help guide them toward a critical technical practice.

2   Background

2.1   The Maker Movement

This study took place in three community-based maker spaces designed specifically for teens. A maker space is a physical place where people make tangible objects using technology that is not readily available for home use. Grounded in notions of social equity, constructionist learning (learning by making), situated cognition, and social learning theory, maker spaces in libraries, museums, and community-based organizations are testing new models of out-of-school learning with digital media. One such model is Connected Learning, a conceptual framework for contemporary learning in a networked, digital world (Ito et al, 2013). A key principle of Connected Learning is that "making, creating and producing are powerful paths to deeper learning and understanding" (Connected Learning, 2014). Production-oriented, interest driven, and peer-supported, Connected Learning finds its full expression in the maker movement and its attendant maker spaces.

2.2   Self-Awareness, Deeper Learning, and Critical Technical Practices

Makers who are unaware of themselves as actors in the making process are, in some way, working blind. Self-awareness is central to deeper, transferable learning in STEAM education as well being a crucial element in the development of engaged, socially responsible behavior (Pellegrino & Hilton, 2012). How might we further develop in today's young "makers" a sense of awareness of themselves so they can contribute to a more socially-aware technical practice tomorrow? One method might be through the use of question prompts, a language tool delivered in the context of the conversations that happen between teen makers and the mentors who guide them. (Brown & Keeley, 2001, Vygotsky, 1978).

3   Methodology

The study took place during Spring 2014 in three after-school programs for youth in Pittsburgh: the Open Labs program at The Carnegie Library of Pittsburgh, the Youth Alive! program at the Children's Museum

of Pittsburgh's MakeShop, and Assemble, a non-profit organization providing community space for the arts and technology. In these three maker spaces, young people had access to digital technologies for drawing images, editing photos, remixing video clips with audio overlay, making music and musical instruments, animating stories, designing and printing buttons, and programming and building robots and three dimensional objects, as well as low-tech tools such as battery-operated motors to build Bug Bots, circuit boards and LED lights, sewing machines, glue guns, and soldering irons.

The study used qualitative methods to study the nature of the question-prompts that teen makers and the adults facilitating after-school maker spaces (called mentors) ask *themselves* when they construct digital artifacts in maker spaces. Data was collected during four focus groups with teens, a series of sketching exercises, three semi-structured interviews with adult mentors, and six periods of observation.
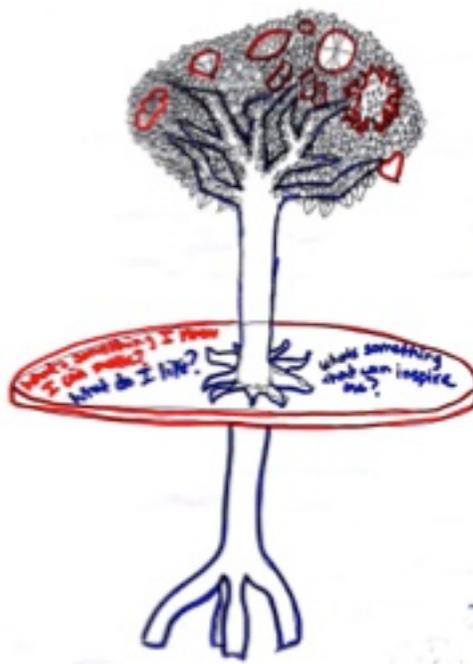

Figure 1. Sketch by teen, 15, depicting a smart "maker table" that prompts makers with questions.

4   Results

Twenty-nine teens participated in the focus groups and six mentors were interviewed. Data analysis was inductive, generating broad themes related to self-as-maker, technology in relation to self, technology in relation to others, process, and resources. The data helped guide the articulation of eight activation questions that reflect both the authentic world of youth makers and the wisdom of mentors, phrased in natural language so as to encourage direct application in maker spaces.

These question prompts can serve as a tool for scaffolding mindful and critical practices in maker spaces for youth. They ask novice makers to think about themselves as makers, think about the link between their personal goals, aptitudes, knowledge, and the materials they have at hand, think about the effect that they have on the objects they make and finally, the effect that their creations might have on others. The eight questions are presented below:

- *What will make me happy?* This deceptively simple question encapsulates an awareness of the deep, emotional connection that exists between the maker and the artifact. It speaks to a fundamental need for interest, motivation, and drive in the making process. To be a mindful maker is to be aware of one's own feelings and how a maker project draws from and shapes our emotions.
- *Who is my audience?* Mindful making acknowledges the social context of making and the performative nature of design.

- *What resources do I have and need?* Mindful makers want to know what resources will serve as a muse to their imagination.
- *What will inspire me to spend my time and effort?* Makers assess the value of a project according to the balance between their knowledge and skills and the degree of meaningfulness that the project has for them. Too much interest coupled with too little knowledge might mean extra time and effort. But if the project is interesting enough, time and effort might be worth it. By asking this question, we begin to plan for engagement in the making process.
- *What do I know?* In the classic version of the inquiry process, learners *begin* by questioning the boundaries of their knowledge and then *end* with a new creation. In maker spaces, the inquiry process is inverted, turned up side down as it were. Makers start by creating and then end with understanding. The question "*What do I know*" should be asked within the context of creating, and not as a precursor to the process.
- *Can I let myself make a mistake?* Interrogating one's willingness to make a mistake also highlights the degree to which one is able to ask another question about risk and that is, *what ways beyond the 'right' way may I use the spaces and resources that guide my making?*
- *How will my creation affect other people?* Maker self-awareness extends to questions about the maker-in-society. But when working with teens in a maker space, it might be that in order to consider the politics of artifacts, teens need questions framed in ways that give a personal context to the objects that they build.
- *What kind of a maker am I?* There is no one right response to this question. The answer, however, may reveal what drives us and helps us anticipate how we might tackle a design problem.

5   Conclusion

This study is a preliminary step in the development of instruments and practices to support mindful making in community-based maker spaces for youth. Although certainly not the only solution, question prompts that occur within the framework of a conversation can be a useful tool to help scaffold deeper thinking about making and a disposition toward mindful and critical technical practice.

6   References

Floyd, C. (2005, August). Being critical in, on or around computing? In *CC'05: Proceedings of the 4th Decennial Conference on Critical Computing: Between Sense and Sensibility* (pp. 207-211). Aarhus, Denmark.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., Schor, J., Sefton-Green, J. and Watkins, S. C. (2013). *Connected learning: An agenda for research and design*. Digital Media and Learning Research Hub. Irvine, CA, USA.

Pellegrino, J.W. & Hilton, M.L. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Washington, DC: National Research Council.

Vygotsky, L. (1978). Mind in Society. Cambridge, MA: Harvard University Press.

What is Connected Learning? Connected Learning. MacArthur Foundation. Retrieved from, http://connectedlearning.tv/what-is-connected-learning, on August 13, 2014.

Browne, M. N., and S. Keeley. (2001). *Asking the right questions: a guide to critical thinking.* Prentice Hall, Upper Saddle River, NJ. 221 p.

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