Using Mobile Technology to Support Innovation Education

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Abstract: Innovation is critical to our prosperity. A vital task in innovation is to understand the context within which problems occur. This poster investigates the potential of mobile technology and location-based learning to help novice innovators identify unmet needs using human-centered design research techniques. Drawing on an authentic situated learning perspective, we describe a place-based investigation activity supported by mobile technology.

Introduction

Serial innovators aiming to make meaningful improvements to our daily lives are driven to identify and understand complex problems. Without understanding the context of problems through research techniques such as field observations, addressing authentic needs is limited to the innovators' speculation and assumption. Unfortunately, opportunities to practice researching real-world problems are limited for undergraduate students. To prepare students for careers in innovation, we need to explicitly teach them how to identify and understand problems from the perspective of those who are most affected. Developments in place-based learning initiatives (e.g. Squire, 2009) suggest an opportunity to create meaningful learning experiences outside the classroom and spread the learning experience throughout the community. We describe an activity facilitated by mobile technology to help novice innovators develop the specific skills necessary to understand the users' experience.

Background

Innovation is the intentional implementation of novel and useful processes, products, or services designed to benefit society applied to a new domain (West & Farr, 1990). A critical aspect of successful innovation is a project's response to a genuine human need. Professionals conduct detailed and systematic observations of a target situation and user to gain the understanding necessary to discover opportunities to innovate (e.g. Beyer & Holtzblatt, 1997). Traditional undergraduate design research curriculum is often offered as a course module, informed by textbook readings and direct instruction in a classroom setting, sending students out into the field to practice the skill alone (Fixon, 2009). These activities lack specific guidance regarding process, reflection and feedback at the actual point of observing user behavior.

Research Method

The goal of this work is to distill design principles for teaching research methods to undergraduates undertaking innovation education. Here we describe the initial design cycle of a design-based research study (Design-Based Research Collaborative, 2003) which utilizes multiple iterative rounds of design and testing to improve an intervention's impact while developing a deeper theoretical understanding of the learning occurring. Our central research questions are to understand how novices conceptualize the process of understanding users and how location-based activities situate the learning of design research decision-making. We applied human centered design research methods (Easterday, et al., in press) including ethnographic observation, interview and cognitive task analysis to investigate common struggles when conducting field observations, compare expert and novice needs finding strategies, and reveal possible opportunities for an educational intervention.

Initial Findings

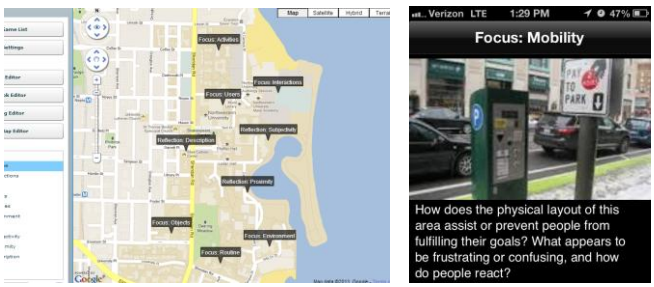
In an ethnographic study of 22 undergraduates learning to be innovators, we found that existing instruction in understanding users was not sufficiently preparing them for the task of needs finding. The novices represented a variety of academic majors and worked on project teams of 4-6 people. An artifact analysis indicated that many learners' field observation data sets lacked objectivity, clarity and depth. Furthermore we discovered that novices often observed alone, comparing their findings with their group members only later after leaving the field, forgetting key information and missing opportunities to learn from other investigators while still on site. Without clear, immediate feedback, many novices judged their efforts adequate and expressed desire to move 'forward' into a new phase of design, reflecting their conception of a linear design process (Lande & Leifer, 2010), unlike professionals who perform reflective, collaborative, on-site analysis to drive further investigation.

Design Rationale

We aim to give students authentic opportunities to practice observing behavior *in situ*, foster reflective dialogue about the observation process, separate their subjective interpretation from observable data and make decisions

when following promising leads. We support location-based learning with the ARIS augmented reality system (http://arisgames.org), which allows us to cultivate a customized digital map with messages that are triggered by proximity according to the learners' GPS coordinates (Fig. 1). Following an orientation session facilitated by an experienced local innovator, we invite small groups of 3 to 5 students to investigate phenomena at various locations throughout the community. Students use handheld mobile devices to track their position within the map space and discover challenges requiring them to observe specific behavior or conduct a group reflection on an aspect of the process (Fig. 2). The system facilitates note and photo taking, tagged with GPS data, which students refer to when they return for a data synthesis and large group debrief phase.

The situated activity structure is developed from an understanding that knowledge is constructed through exposure to and interpretation of new phenomena, and that this process is directly influenced by the context in which the learning occurs (Lave & Wenger, 1991). According to expert innovators we interviewed, the knowledge gained from investigating complex situational behavior should not be limited to the subjective interpretation of a single individual, but instead compared with others working on the same task. This aligns with Roschelle and Teasley (1995) who describe collaboration as a negotiation between individuals resulting in the construction of shared meaning and conception of a problem. Therefore when teams debrief after an observation session they are not only clarifying what they saw as individuals but the group builds knowledge that forms the basis for the team's future reference and decision making (Stahl, 2006).



Figs 1 & 2. ARIS map and sample challenge interface

Future Work

Using mobile technology and computer supported collaborative learning principles we are extending traditional innovation education into the field where learners have struggled. Early tests suggest this activity is engaging and interesting for novices, and helps guide meaningful conversation. The next steps on our research agenda include further evaluation of the learner's experience, testing additional elements of gameplay, and developing a structure for user contribution of observation challenges. This project will be an asset to the Learning Sciences because it will help inform the design of mobile place-based learning activities and identify principles for helping novice innovators as they develop skills to understand the context of user experience.

References

Beyer, H., & Holtzblatt, K. (1997). *Contextual design: defining customer-centered systems.* Morgan Kaufmann.

Design-Based Research Collaborative (2003). Design-based research: An emerging paradigm for educational inquiry, *Educational Researcher,* 32 (1), 5-8.

Easterday, M., Gerber, E., Rees Lewis, D. (In Press). Applying human-centered design methods to learner centered design: A case study. In A. Person (Chair), *Symposium on Human-Centered Approaches to Developing Usable Educational Technologies.* Symposium conducted at European Association for Research on Learning and Instruction 2013, Munich, Germany.

Fixson, S. K. (2009). Teaching innovation through interdisiplinary courses and programmes in product design and development: An analysis of 16 US schools. *Creativity and Innovation Management, 18(3).*

Gagnon, D. (2010). ARIS [computer software]. Available from http://arisgames.org

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lande, M. & Leifer, L. Difficulties student engineers face designing the future. *International Journal of Engineering Education*, 26,2 (2010), 271–277.

Roschelle, J. & Teasley S.D. (1995) The construction of shared knowledge in collaborative problem solving. In C.E. O'Malley (Ed.), *Computer-Supported Collaborative Learning*. (pp. 69-197). Berlin: Springer.

Squire, K. (2009). Mobile media learning: Multiplicities of place. *On the Horizon*, 17(1), 70-80.

Stahl, G. (2006). *Group cognition: Computer support for building collaborative knowledge.* Cambridge, MA: MIT Press.

West, M. A., & Farr, J. L. (1990). *Innovation and creativity at work: Psychological and organizational strategies.* John Wiley & Sons.