Mobile Learning Classroom Practices and Integration

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Abstract

A short time ago mobile learning could be framed as immature in terms of classroom integration (Traxler, 2007). More recently, however, we have seen rapid growth in the number of educators designing their own mobile-mediated learning environments. As a result, mobile learning is maturing as a pedagogical practice through the combination of refined theoretical understanding of its affordances, an increase in the number and types of mobile applications (many of them free), and growing communities of practice (Dikkers, Martin, & Coulter, 2012). In this paper, we briefly present the design choices and goals of nine educators (representing a range of contexts) who integrated innovative forms of mobile learning in their teaching. We then use a single illustrative example to highlight themes that emerged from analysis of the nine cases, namely four practices designers employed as they implemented mobile learning. Using Pinch and Bijker's (1984) design-based perspective we conduct a cross-case analysis (Stake, 2006) to gain insights into user/designer intention, goals, and needs. Finally, we use this analysis to consider next steps related to the design of mobile tools and learning environments.

Overview

Over the last five years, educators have seen a proliferation in the number and range of tools available for designing localized mobile learning experiences. This rapid growth has shifted the conversation from the potential of mobile learning, to actual implementations of mobile learning. For example, the New Media Consortium's (NMC) 2010 Horizon report (Johnson et al., 2010) notes that the growing ubiquity and power of mobile technologies is making mobile devices more and more relevant as learning tools. In 2010, according to the NMC, integrated use was just over the 'horizon'. In 2012, the NMC shifted this view, noting that "mobile apps are the fastest growing dimension of the mobile space in higher education right now, with impacts on virtually every aspect of informal life, and increasingly, every discipline in the university" (Johnson et al., 2012).

To study how educators are applying mobile learning in different contexts, we analyzed nine cases where mobile technologies were used to engage learners in design experiences and/or place-based learning. We then analyzed a single, embedded case in more depth as a way to more thoroughly illustrate the themes that emerged across the nine cases.

Our initial findings are intended to provide data to: researchers; mobile developers, and educators looking to implement mobile-based learning (Dikkers, Martin, & Coulter, 2012). Additionally, the representative case we present is intended to stand on its own as a model of practice that confirms the promise of mobile learning (Peters, 2007; Pea & Maldonado, 2006) and can be translated and integrated into professional development experiences and classroom practices.

Theory

A short time ago mobile learning could be, and was, framed as immature in terms of classroom integration (Traxler, 2007). In the last five years, however, a growing number of educators have become interested in leveraging the affordances of mobile technologies to support learning. As a result, the adoption and customization of mobile learning has accelerated greatly. It is important to note, however, that mobile technologies are often taken up in remarkably different ways than expected (Squire & Dikkers, 2011). As a result there is a growing need for research that carefully examines how app developers and users (e.g., educators and students) conceptualize, use, and shape mobile technologies.

Taking up a *social construction of technology SCOT,* (Pinch and Bijker, 1984) perspective, we frame teachers as key stakeholders and change agents in the ongoing development and application of mobile learning. This approach assumes that innovative uses and adaptations of mobile applications provide insights into the interests, priorities, and intentions of educator and learners. Similarly, understanding how educators "take up," adapt, and modify mobile technologies in situ can be used to inform the next generation of mobile applications and mobile-based learning environments.

Method and Participants

In this study, we gathered data from nine educators who use mobile learning and qualitatively analyzed their design choices and goals to identify common themes. We used a short preliminary screening interview to select nine cases that represent a range of contexts and approaches. Throughout the study, each educator presented their own case data by answering a template of questions requesting them to discuss: their theory of learning, development process and design decisions, challenges and successes in practice, and ongoing pedagogical insights and reflections. These written reflections provided essential data that show educators' perception of the mobile tools and learning experiences that best support learning. The nine cases we analyzed include a spectrum of expertise, contexts, subjects, and approaches (see Table 1).

Table 1: Cases of Mobile Media Learning applications

Designer Context	Learning Context	Subject (if applicable)	Type of use
Teacher	Formal school on field trip	Science & Writing	Data collection & place-based interactive story
Park curator	Formal school on field trip to park	Science	Place-based gaming
Researcher	Informal free time	Science	Gaming
Camp counselor	Informal outdoors	Life skills/hiking	Place-based gaming
Teacher	Formal school in community	Language	Place-based gaming
Teacher	Formal school in community	Social Studies/Civics	Data collection + Game design
Researcher	Informal event	Civics	Place-based gaming
Museum Curator	Formal school on field trip	Social Studies	Place-based gaming
Librarian	Formal and informal	Information gathering	Tour

Full disclosure: All of the written results were added to chapters of a now published work, Mobile Media Learning, with ETC Press.

In our analysis, we iteratively selected and refined common themes across the cases. Upon identifying common themes, we followed up with a second round of analysis. In particular, we looked for the relationship between learning goals and design considerations, including perceived advantages and challenges faced by each of the educators. For instance, the prevalence of discussion around place-based gaming (adventures that require players to physically move around a space to complete objectives within the game) led to deeper investigation of this theme, and eventually to an understanding that educators were conceptualizing and applying place-based learning differently.

Participants were selected based on their use of mobile media for learning and their perception that they had gained insights worth sharing with others. Because participants tended to focus on the successful components of their implementations, however, there is a clear skewing of the data toward positive perceptions of mobile learning. Because

the field is new, we understand that early adopters might show more enthusiasm for mobile learning than a larger, more canvassed, sample. Still, this sample allowed us to explore the *direction* early adopters are interested in taking the media and their intention for future use. For instance, the "Type of use" presented above shows a clear pattern of using mobile to structure learning activities in otherwise unstructured spaces (e.g., natural areas and public spaces). This isn't intended as a measure of the success of participants' efforts to create place-based learning, but hints at the types of uses they envision. It also sheds light on the tools and functionality that might best support these goals.

Illustrative Case Analysis

In this paper, we further examine a single case to illustrate four themes that emerged across all nine cases. We found that our participants commonly: 1) use participatory design strategies; 2) encourage engagement through design; 3) employ mobile media as a tool for just-in-time information gathering; and 4) leverage place-based experiences to foster complex systemic thinking.

In the selected case, Up River, educators and mobile designers Jim and Mark explore how place-based interactive storytelling might be used to teach ethnographic skills and explore the relationship between local cultural and ecological systems (Wagler & Mathews, 2012). Up River is a GPS-based mobile story created in the St. Louis River estuary as an educational experience for learners to 'flow' up river and discover the complex systems that influence the life of the river.

In their design, Jim and Mark leveraged place-based narrative and mobile devices to deliver quests and guide users to interact with virtual characters, as well as people in the real world. Another key characteristic of this case is that Jim and Mark used Up River as part of a workshop where students and teachers collaborated to design their own place-based mobile stories. We use this case to exemplify the four themes that cut across the nine cases.

Participatory design strategies

Jim and Mark often sought ways to engage teachers and others in the design process. In the case of Up River, they gathered a regional 'focus group' as a method for generating ideas for their design. They also used these groups as checkpoints for refining the authenticity of their story as it was iteratively improved. Jim and Mark commented that using local resources was a way to quickly generate design ideas that resonated with local users:

> "[Expert partners] quickly came up with story ideas and components on sticky notes, arranged them into a narrative, and reported out to the group. The initial, rough narrative for Up River was born at this session."

In part, Jim and Mark used this approach to leverage the knowledge of local stakeholders and capture real stories that were tied to the specific locations where Up River was played. A strategy that increased learners' engagement. This approach was common across the cases, as designers sought out local expertise as a way to identify quality themes and ideas, and improve initial designs.

Encourage engagement through design
While Jim and Mark designed Up River for students and teachers to play, they intended it to serve as an entry into design:

> "We wanted Up River to immerse teachers and students in the estuary, but also serve as a model for how they could design a similar experience with their own students... we wanted participants to transition from thinking like players to thinking like designers."

> "As participants began to develop a deeper sense of the core ideas — especially the confluence of place, ethnographic fieldwork, and mobile– based storytelling — we asked them to begin planning a similar project they could implement at their own school."

In order to achieve this goals, they had teachers and students play Up River as part of a workshop, then helped them begin designing an ethnography-based mobile story for their own community. As part of this process, the teachers and students had to identify a theme or issue, select a location, and brainstorm possible resources; including interview subjects, community partners, and archival documents. Both teachers and students were eager to engage in this process and showed interest in continuing their work outside of the workshop:

> "Many teachers were intrigued by this approach and easily began generating ideas for how they could conduct ethnographic research with their own students."

Fostering opportunities for others to learn through design was a key theme that emerged across the cases. Similarly, a key approach or strategy that was commonly used to support this goal was having students first play, then design their own games. One key point related to this goal is that it highlights the need for authoring tools and design processes that are easy for students and teachers to learn and use. To support

this goal, the field needs to continue investigating strategies for engaging students in making their own games, training teachers how to facilitate design, and developing tools that support design.

Information gathering
Designers repeatedly perceived that mobile learning provided new opportunities for collecting and consuming information. This might be as simple as learning the resources available in a library via a scavenger hunt; or in the case of Up River, having students *collect* scientific and ethnographic data via their mobile device.

A key goal of Up River is engaging players in seeking, absorbing, and collecting stories about the St. Louis River Estuary:

> "Up River also encourages players to observe, interview, and record real people, places, and interactions. Indeed, Up River served as a model during our workshop for how readily ethnographic documents can be incorporated into a mobile story."

> "This prompt, along with the additional details delivered via the wharf report, encourages players to notice and ask questions about the various materials being loaded and offloaded there."

An important point here is that the goal of Up River was not to simply consume content on the mobile device, but also engage users with the physical surroundings. Indeed, Jim and Mark weren't satisfied with an entirely digital set of interactions and made it a design goal to include real people and real interactions. They wanted to "...nudge players to talk with and even interview real people."

Leverage place-based experiences for systemic thinking
A final common theme across all nine cases, is that educators employed mobile technologies to support community-based learning and encourage systemic thinking. Basic information and data is widely available inside classrooms via the Internet, however people, places, and complex realities are often more accessible outside of the classroom.

Jim and Mark's design exemplifies this approach in that it guides learners as they physically travel through their community:

> "In Up River, players travel upstream from the Duluth harbor in search of wild rice and native fish species. Along the way they become physically immersed in the

estuary, exploring tourist attractions, industrial sites, restored habitats, and fishing piers."

Along the way, learners interact with real and virtual people and get "just in time" information related to the cultural and ecological systems at play in the estuary.

"These interactions, and the stories players hear, help connect them with the people and places in the estuary."

The ability of mobile devices and apps to help users navigate a set of experiences in specific, content rich places was perceived as a natural and valuable component of mobile learning across all of the cases. Mobile learning experiences were also perceived as a way to remediate users' experience of place. Not only can mobile devices help direct players to a specific places, they can also provide a digital interface that 'interacts' with the learner and helps them 'see' new, unique, and differently while they were in the place.

"More significantly, they experience the estuary by walking on the shore of Lake Superior... Learning about the estuary through the stories of people who live and work there helps players 'see beyond' what is in front of them, making transparent some of the complex systems at play in the estuary."

Discussion

Across cases, we see designers creating innovative mobile learning environments. Instead of building simple games for delivering content to students in a classroom, however, the designers sought to:

1) Use participatory design strategies
2) Encourage engagement through design
3) Employ mobile media as a tool for information gathering
4) Leverage place-based experiences to foster complex systemic thinking

These four themes can inform the field of mobile learning in two key ways. First, they can be used to inform the development of new mobile tools, particularly tools that can be used to support place- and design-based learning. Second, they can be used to further iterate the design of mobile-centered learning environments. Below are some quick talking points that can be used to guide further discussion in this area.

Additional support for field-based data collection

Across the cases, a key factor driving educators' interest in mobile learning is its potential to support place-based field experiences. One component of this approach includes engaging learners in data collection and curation tied to specific places. By taking advantage of both the memory on mobile devices and cloud-based storage, content created during field-based experiences can be collected then sent or taken back to a teacher, colleague, or team member to support further learning activities. This ability to keep digital "artifacts" and have them available in a personalized online repository for later use was mentioned as a growing area of exploration in our study. As a result, we see a need for developing new mobile tools to facilitate this process and integrating this functionality into existing tools.

Ease of use and accessibility
In our cases, we consistently saw field-based mobile learning experiences being used to support follow up activities - including having learners make their own mobile games, stories, tours, etc. This suggests the need for simple, easy-to-use tools that lower the barrier for participation in the design of mobile media. Yet there is a tendency for software to become more difficult over time as new features and capabilities are added. As a result, developers building tools for mobile learning should strongly focus on improving user interfaces and producing effective tutorials. Features like drag-and-drop, color-coding, and/or multiple, skill-based versions of editing software (e.g., express and pro) would be welcomed by educators. Developing a tool that is accessible could further expand the number of educators designing mobile learning environments.

Leveraging mobile tools to track student activity and learning
Building new mobile tools that help track student activity and relevant learning behavior across contexts (e.g., classroom, home, community) might also prove useful for educators and learners. For instance, creating consistent badge or learning recognition systems, which was explored in two of our cases, is growing in popularity, but still requires further research.

Conclusion
Our cases illustrate the potential for designers of mobile learning experiences to produce rigorous and generative experiences across a range of content areas – including second language, science, and history classrooms. They also represent much needed collaboration between educators, domain area experts (e.g., scientists and historians), and programmers coming together to envision and iteratively (re)design new mobile tools and resources to support other teachers as they create their own mobile learning experiences.

The cases mentioned in this paper provides evidence that mobile learning is maturing as a pedagogical practice through the combination of refined theoretical understanding of its affordances, an increase in the number and type of mobile applications, and a growing community of practice. Additionally, teachers' conceptualization and use of mobile learning reveals design considerations for ubiquitous learning; accessibility of tools; and cultivating learning experiences that are place-based, engaging, design oriented, and complex.

With the recent growth of mobile learning, it is fast becoming possible for teachers to use, design, and/or customize their own mobile learning experiences to fit local learning goals and contexts. While more exemplars are needed in the field, our study shows the potential for mobile learning to support teaching and learning situated within real-world contexts. They also demonstrate several strategies (including the cultivation of a "community of designers") for building educators' capacity for designing their own mobile learning activities.

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