

## Augmenting Large-enrollment Instruction with Mobile Learning

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**Abstract:** In many higher education institutions, mobile devices, such as cellular phones and media players, are ubiquitous in students' lives (Lenhart & Madden, 2007). Therefore, practitioners can leverage mobile devices for learning. The purpose of this study was to determine the amount of students that study on mobile devices in a large-enrollment introductory course, their preferences, and the most effective methods to deliver course content to mobile devices. The researcher found that a majority of students did not study mobile learning content on mobile platforms. However, students that utilized mobile devices to augment their studies preferred mobile learning to utilize downtime and their current resources. The researcher also discussed design implications for the development of mobile learning content.

### Introduction

The rising cost of education is a major problem at higher education institutions (Twigg, 1999). Higher education institutions are expected to do more with less due to decreasing revenue and increasing enrollments. Many large-enrollment courses exist to ensure a cost-savings is achieved. According to Twigg (1999), administrators of higher educational institutions would like to lower the costs of these large-enrollment courses as long as the quality of instruction is not lowered through a variety of methods including leveraging technology. In many higher education institutions, mobile devices, such as cellular phones and media players, are ubiquitous in students' lives (Lenhart & Madden, 2007). Therefore, practitioners can leverage mobile devices for learning.

O'Malley et al. (2003) defined mobile learning as "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies." In this study, mobile technologies are defined as handheld-size devices such as cellular phones, PDAs, iPods, and other media devices. Mobile learning has been implemented in many different environments including language learning, industry, medicine, K-12 education, and higher education (van Barneveld & Shaw, 2006).

### Mobile Learning in Higher Education

In higher education, mobile learning has been used for many different purposes including: organization, communication, synchronous lectures, and asynchronous

lectures. Corlett et al. (2005) studied the use of PDAs as an organization tool in higher education. They found that most students used their PDAs as a calendar and as a communication tool when within a wireless network. Few students used their PDAs to access course content. Therefore, a majority of students in their study wanted to organize their schedule and manage their time with PDAs, as opposed to using it as a method to access course content.

Students are also able to synchronously attend lectures via mobile learning technologies. Using the China Education and Research Network, students in China were able to log in synchronously and participate in a large-enrollment blended classroom (Wang, Shen, Novak, & Pan, 2009). The blended classroom included approximately 250 in-class students and 750 mobile students. Mobile students were able to view the lectures live on their mobile devices, submit messages, and respond to polls that the instructor could see and address in class. Students who participated in this class were also able to review the lecture asynchronously, as it was recorded. The researchers believed that a reward system may be necessary at the beginning of a course, mobile activities should be short and not reading intensive, instructors should conduct question and answer sessions to address topics that students are interested in, and activities should be created to facilitate interactions with other classmates through their mobile learning system.

Podcasting is a method that students can use to asynchronously learn course content. In higher education, podcasting has been used to deliver lecture content. Ogawa and Nickles (2006a) studied effectiveness of podcasting in a large-enrollment course. They compared examination scores on common examinations across multiple semesters. Students who listened to lecture podcasts scored 17.34% higher on midterm examinations and 6.98% higher on final examinations. Ogawa and Nickles (2006b) also studied students' perceptions and preference towards podcasted lecture content. Students' perceptions of large-enrollment courses were improved through lecture podcasting, as lecture podcasting accounted for typical issues with large-enrollment courses, such as course drift.

Although there are many different methods to implement mobile learning into instruction, many limitations of mobile devices exist. A typical problem with mobile devices is the size of the screen (Hayes, Joyce & Pathak, 2004). In many cases, the size limits the amount of content and how it is viewed. Keegan (2002) further discussed mobile devices' small keyboards and input devices, which can be uncomfortable to users and may limit communication.

## **Setting**

The study was conducted on an introductory computer technology course at a research extensive university in the Western United States. Approximately 800 students enroll in the course each year and are from a variety of disciplines. The introductory computer technology course was taught by a course instructor, course coordinator, and 11 teaching assistants.

The course consisted of two parts, a lecture and a laboratory. Both the lecture and laboratory parts of the course utilized a blended mode of instruction. The lecture included two complementary parts, a traditional face-to-face lecture in a lecture hall and a podcasted lecture. Each week, students were required to attend the face-to-face lecture session at a specified time and complete a complementary podcast at their convenience. The podcast also included an on-line quiz in a course management system. The laboratory portion of the course included two face-to-face meetings a week with a teaching assistant. Students completed assignments in the lab and in an on-line course management system.

Students could access both lecture and laboratory course content on mobile media devices. The lecture podcast was available for download and could be transferred to different mobile devices including cellular phones and media players. The lecture podcast was available in multiple formats to account for multiple media player capabilities. The podcast formats included video, image and video, and audio only podcasts. Laboratory content was not designed for mobile devices, but could be accessed via mobile devices with on-line connectivity and were either interactive or passive in nature. However, the students' ability to access content on their mobile devices were dependent on the capabilities of their devices.

### **Research Questions**

Since many methods of implementing mobile learning exist, the researcher investigated the amount of students that study using mobile devices, their preferences, and the most effective methods to deliver course content to mobile devices. The students enrolled in the introductory computer technology course had the ability to access course content through mobile technologies. The researcher posed the following research questions:

1. How many students study using a mobile device? Why did they choose to study using mobile devices?
2. Do students prefer to study on mobile devices or fixed-location devices? Why do they prefer mobile or fixed-location devices?
3. What methods of mobile learning content delivery were most effective for students? Why were the methods most effective?

Since approximately 35% of university students were enrolled in large-enrollment introductory courses (Twigg, 1999), the study can have a significant impact on the way undergraduate students are taught, especially in courses that utilize mobile learning tools.

### **Methods**

To answer the research questions, the researcher conducted a survey of the students enrolled in the course and conducted follow-up interviews with students. The survey included five open-ended questions. The following questions were included in the survey:

- What means of transportation do you use to get to and from school?

- What mobile devices do you carry with you to school on a daily basis?
- Do you study on a mobile device? Why or Why not?
- Do you prefer to study on a mobile device or on a fixed-location device (i.e. computer)? Why or Why not?
- Would you prefer interactive or passive learning material on your mobile device while traveling to/from school? Why (Please give specific reasons)?

The researcher used an open and axial coding method to identify themes that existed in the survey data. After coding the survey data, the researcher conducted interviews of students who participated in the introductory computer technology course. Students who completed the survey were given the opportunity to participate in a follow-up interview with the researcher. The interview data were also analyzed with an open and axial coding scheme. The interviews were conducted in a semi-structured format using the following interview guide:

- Do you use mobile devices (e.g. iPods, media players, cellular phones, etc.) for academic purposes? How so?
- Do you study while commuting to and from school? How do you study?
- Did you enjoy studying on a mobile device? Why or Why not?
- What type of content did you enjoy on your mobile device? Why?

After the interview data were analyzed, the researcher conducted follow-up interviews with the interviewees to conduct member checks. The member checks ensured the findings were accurate and interpreted correctly.

## **Participants**

A total of 345 of the 405 students enrolled in the course students participated in the open-ended survey. The students traveled to and from the university by commuting by car, mass transit, biking/skating, or walking. As a main means of transportation, 42 percent of the students commuted by car, 16 percent used mass transit, six percent biked or skated, and 36 percent walked. Ninety-three percent of the population had a mobile device with multimedia capabilities. A total of six students responded to the researcher's request for interview participation. All six students were interviewed, and member-checks were conducted.

## **Results**

RQ 1: How many students study using a mobile device? Why did they choose to study using mobile devices? To answer the first research question, the researcher coded the open-ended survey to determine the percentage of students that studied using a mobile device. Subsequently, the researcher further coded the responses to the survey and interview data to determine why students chose to study using mobile devices. A total of 345 students completed the open-ended survey. Of the 345 participants, 58 students or 16.81% of the sample studied material for the computer technology course using a mobile device. Two hundred eighty-seven or 83.19% of the participants only studied on a

desktop or laptop computer at a central location. Interestingly a majority of students chose not to study on mobile devices even when mobile content was available.

Two themes emerged from the survey data, which illuminated reasons that students chose to study using mobile devices. The first theme that emerged from the data was the students' ability to maximize the use of their open times. Students felt that their travel time or time between classes could be used to increase their productivity. One student stated, "Because this kind of mobile device allows me to study whenever, wherever, and accomplish more during times that I usually accomplish nothing." Another student mentioned, "I like studying going to school because I don't like to study at home. And when I go to school, I feel like it is school time, unlike when I am going home." These comments demonstrated the students' desire to maximize available time. The second theme that emerged from the data was the students' ability to utilize their current technological resources. A student stated, "Using my iPod for school makes me feel like I get my money's worth cause I can use it for more than just music."

The interviews allowed the researcher to probe further into the themes that emerged from the survey data. An interviewee discussed the first theme in detail and stated, "I like having the edge right before going to class. I couldn't do that without having the lectures on my cell phone. Like when we had the exam, I think I did well because I could get that little extra bit of studying done and hear the professor's voice in my head when I took the exam." Another interviewee stated, "Me and my friend carpool and are in the same lab. We listened to the podcast every Tuesday and Thursday and could talk about it because we were stuck in traffic. I felt that we got a good use of time, 'cause we usually complain about traffic, but we got something done instead." These two comments demonstrated the students' ability and desire to maximize the time that they had available. The second comment truly expressed the students' views about utilizing down times.

The interviewees also discussed the second theme, utilizing current resources in detail. All of the interviewees mentioned aspects of utilizing their current resources, but one quote truly demonstrated their ability to utilize their current resources. An interviewee stated, "Well, I didn't really think that I could use my iPod for school until I came to this class. Now, I kind of like it and think that it can be good. Also, I feel like I'm making good use of it like I can study with it!"

RQ 2: Do students prefer to study on mobile devices or fixed-location devices? Why do they prefer mobile or fixed-location devices? The researcher answered the second research question by using an open and axial coding method of analyzing the survey and interview data. Based on the survey data, only 31 students (8.99%) preferred to study on a mobile device, as opposed to a fixed-location device. One theme emerged from the survey data. The theme that emerged from the data was the students' ability to designate places and times that they preferred to study. A quote that truly exhibited the students' preference to studying in a specific location was, "I do not want learning material on my mobile device. I would feel attached to school if it was on my cell phone. I would like to have my 'Me' time." Another student stated, "It is an intrusion on our personal time, via

our more personal devices (cell phones) I strongly stand against it.” These two quotes gave evidence to support the students’ desire for a distinction between personal time and school time. An interviewee who was strongly against mobile learning elaborated on this theme by saying, “I only study at home in the late evenings and at school. I need to see a difference between school, work, and PERSONAL time.” This interviewee stressed the importance of personal time and did not want other aspects of her life intruding on it. Another interviewee mentioned, “I tried to do some of the on-line stuff on my phone, but it was so slow and felt like a waste of time. When I do it on my laptop at home, it’s fast and I don’t worry about anything like connection.”

Overall, it appears that students do prefer to study in a specific location, as opposed to distributing their studies. However, 8.99% of the sample did have a preference for studying on mobile devices in multiple locations. These students mentioned their ability to maximize the use of their time and utilizing their resources to be major reasons for preferring mobile devices.

RQ 3: What methods of mobile learning content delivery were most effective for students? Why were the methods most effective? To answer the third research question, the researcher analyzed the survey data and interview data to identify effective methods of mobile instruction. Based on the survey data, one theme emerged. Students preferred and found passive content to be more effective than interactive content. The students felt that they were not able to concentrate on interactive content while they were in transit or between classes. They felt that the passive material allowed them to listen to or read content on their mobile device while still being aware of their surroundings. A student mentioned, “I like the podcasts because I don’t want to miss the bus stop.” Another student stated, “I don’t like to interact with things (like when I play my DS) when waiting for classes cause I always lose track of time and get late.” These students’ perceptions demonstrated their need for awareness of their surroundings when they have a short period of time to study and especially while they are in transit.

The interviewees also preferred and found passive mobile content to be more effective. Based on the interviews, two themes emerged. The first theme was consistent with the student survey, where they wanted to be aware of their time and environment. A quote that captured the first theme was, “I always need to know what is going on around me ‘cause I drive half the time. I know that I can talk with my friend while driving to school, ‘cause I always did that. But I can’t do things on my phone; it’s too distracting. But, I do like to talk about the podcast with her while we are listening to it.”

The second theme was studying review material instead of new material using a mobile device. The students felt that review material was more effective than new material because they needed less effort to review material than to learn new material. A quote that captured this theme was, “I listened to the podcast on the way to school but I didn’t understand it. I had to listen to it at home on my computer and takes notes to understand it. When I reviewed on the bus the next time it helped a lot more than just trying to learn it the first time. That’s why I only review the lecture on my iPod and don’t learn it on it.” This student learned the material best by initially learning the content in a more

traditional manner and subsequently was able to review effectively thereafter with a mobile device. Another student stated, "I have like 10 minutes between classes and don't have the time to learn new stuff. I do review and it works. Got a perfect on a bunch of quizzes!" This student made it evident that it was difficult for her to learn new material because she was studying between classes. She found that small mobile review material helped her to achieve in her class.

## **Conclusion**

In conclusion, 83.19% of the students in the large-enrollment course studied in a fixed-location when mobile content was available to them. Of the students that utilized mobile content, they studied with mobile materials because they were able to utilize typical "down times" and felt that they could truly use their mobile devices to their fullest potential. Furthermore, only 8.99% of students preferred to learn using mobile devices than other traditional means of learning. It appeared that students did not prefer to learn on mobile devices because they felt that it was an invasion on their personal time. Of the students that preferred to learn content on mobile devices, they preferred content to be review material, passive in nature, and short in duration. The researcher believed that mobile learning materials can augment students' learning experiences. However, mobile learning should be implemented with an understanding of the best ways to implement them in practice.

## **Implications for Practice and Future Research**

The study revealed potential design considerations for mobile instruction in large-enrollment courses. Based on the results, 16.81% of the student population utilized mobile devices for learning, while 8.99% preferred mobile learning to traditional learning. Therefore, the researcher believed that practitioners that want to implement mobile learning into their instructional pedagogy should consider their students' background and understand that mobile learning content may not be used by all students. Based on the findings, practitioners should create mobile learning material that helps students to review content covered in class or content that is typically completed in a fixed-location. Content should also be passive in nature and relatively short, as students prefer to be aware of their environment and may not have much time available to complete mobile material based on their time and location.

The goal of the study was to determine the amount of students that study on mobile devices, their preferences, and the most effective methods to deliver course content to mobile devices. Several items emerged that have implications for future research. The first item of interest is exploring the achievement of those that study on mobile devices, as opposed to those that do not. This could add to the body of literature and help practitioners to determine modes of content delivery that increase learning. The second item of interest is exploring the types of interaction that exist when utilizing mobile learning content. One of the interviewees discussed using passive content and actively discussing it while in transit. Even though students did not prefer interactive mobile content, further study should be conducted to investigate if and how mobile content may increase student-student interactions.

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