ACCOMMODATING MOBILE LEARNING IN COLLEGE PROGRAMS

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ABSTRACT
Mobile devices and applications are expected to have a significant impact on teaching and learning in the near future. Yet colleges and universities are currently facing severe budget constraints and discretionary funding is restricted for new initiatives. The question addressed in this paper is: "What strategy should an institution of higher learning with limited resources use in adapting the capabilities of mobile devices to benefit its academic programs?" To help answer this question, students were surveyed to identify their perceptions on the importance of a selected set of mobile learning functions, their experience with using those functions, their recommendation for a mobile learning adoption strategy, and information on the particular mobile devices they possess. The recommended strategy was "pick and choose special capabilities to develop" with the selected functions being (1) Receive alerts and reminders about assignments and appointments concerning the course being taken; (2) Communicate individually with faculty, an advisor, or other students using voice, email, or text messaging; (3) Post or reply to items in a poll, discussion board, or other application; and (4) Download and review lesson materials from a course being taken. Other recommendations included techniques for faculty and student support services as well as institutional policies for limiting models of mobile devices for use in courses, making online courseware for laptops and desktops the same as mobile learning courseware, and making the opportunity for mobile learning optional.

KEYWORDS
mobile learning, online learning, distance education, distributed education

I. INTRODUCTION

Schools of higher education have typically adopted new technologies introduced into the marketplace in order to make learning more effective, accessible, or affordable. The pace of formal adoption and diffusion may not always be quick, but institutional barriers and faculty resistance to the introduction of technological advancements to the college classroom are ultimately overcome [1]. Roughly 15 years after diffusion into the market place, the modern college classroom is highly dependent on access to wireless personal computers and the Internet.

According to some business analysts, mobile device technology has now moved to the mainstream. For example, International Data Corporation (IDC) – a provider of market intelligence for the information technology, telecommunications and consumer technology markets – predicted "2012 will also be the Year of Mobile Ascendency as mobile devices (smartphones and media tablets) surpass PCs in both shipments and spending…" [2]. In the 2011 Horizon Report, a collaboration between the New Media Consortium and the Educause Learning Initiative predicted that mobile devices were within one year of having a significant impact on teaching and learning [3]. In the 2012 Horizon Report, the same status was assigned to Mobile Apps [4]. The question addressed in this paper is: "What strategy should an institution of higher learning with limited resources use in adapting the capabilities of mobile devices to benefit its academic programs?" In this context, a *mobile device* is defined as any electronic device that students

might normally carry around while on the go and can connect to the Internet via Wi-Fi or a cell phone service (e.g., smart phones, tablet computers, and some eReaders) and *mobile learning* is defined as the use of mobile devices in support of the effectiveness, accessibility, or affordability of educational programs.

II. BACKGROUND

Approaches to Mobile Learning

Many institutions of higher learning have begun adopting the use of mobile technologies into their academic programs. Any of three approaches appear to be applied individually or in combination.

1. Issue Mobile Devices

Some universities issue mobile devices to all or a test selection of faculty and students and encourage them to make use of these devices in their academic programs without the university modifying its information technology architecture or courseware. The idea is for faculty and students to experiment with the inherent features and capabilities of the devices they are provided to enhance class experiences. In one such test, Abilene Christian University (ACU) issued Apple iPhones or iPod Touches to a large selection of faculty and students [5]. An example cited described the experience of one of the students visiting the National Gallery in Washington D.C on a class assignment. Not only could the student use her smartphone to look up more information about a particular piece of artwork on the web, but she could take a photo of that piece and make notes summarizing her reactions to it for uploading to the course discussion forum. This type of capability is in keeping with the notion that the mobile Internet is not "… just a way to do old things while moving. It will be a way to do things that couldn't be done before" [6].

2. Deploy Special Apps

Other universities invest in the deployment of software applications (apps) that enable students and faculty to more easily interact with selected university services on their own personal mobile devices. Princeton University has introduced *i*Princeton, a set of apps for all types of student-owned smartphones that gives students such capabilities as accessing course materials from the course website, searching the university library resources, and downloading audio and video lectures [7]. One of the special applications included in *i*Princeton, as well as the learning management system of more than a thousand other educational institutions is Blackboard Mobile Learn This special app which is downloadable from Blackboard.com to Apple, Android, and Blackberry mobile devices enables students and faculty to "…access documents in multiple formats, post announcements, create threaded discussion posts, upload media as attachments to discussion boards and blogs, create content items within the course map, ...take tests, and receive push notifications for important course updates or changes" [8].

3. Make Courseware Mobile-Friendly

Some institutions have modified the design of their courseware and communication strategies so that students may more easily interact with course materials and carry out assignments using their personal mobile devices. For example, some designers believe that courseware for mobile learning should be broken into bite-sized chunks that can be viewed in the few minutes that individuals have available to them when traveling [9]. The School of Oriental and African Studies of the University of London conducted a pilot program using mobile learning to improve access to distance learning courses they were conducting for students in several Southern African states [10]. A part of the pilot effort involved redesigning courseware so that it could be implemented more readily on mobile phones of the period. This included greater emphasis on audio-visual content in place of long passages of text and interactive features such as multiple-choice quizzes instead of essay responses to open-ended questions. The pilot made use of text messaging by tutors to encourage completion of assignments and by students to ask tutors for help.

Mobile Learning Functions

The literature describes a number of mobile learning functions that can be carried out on mobile devices [11] [12] [13] [14] [15]. The following functions are frequently identified:

- Administration: Review administrative information about a course the student is taking or thinking about taking (e.g., syllabus, faculty bio, grades).
- Alerts: Receive alerts and reminders about assignments and appointments concerning the course being taken.
- Communicate: Communicate individually with faculty, an advisor, or other students using voice, email, or text messaging.
- Discuss: Post or reply to items in a poll, discussion board, or other online collaborative applications (e.g., Wiki) associated with a course being taking.
- Download: Download and review lesson materials (e.g., HTML, Word, PDF, AV presentations) from a course.
- Live Interaction: Interact during live instructional sessions (e.g., webinars, games, simulations).
- Register/Withdraw: Register or withdraw from a course.
- Search Library: Search for and review materials available in the university library.
- Search Web: Search for and access web-based information related to course content or an assignment.
- Upload: Upload items recorded with a mobile device (e.g., notes, location, photos, podcasts) for use in a course.

If an institution of higher learning were to enable and support the full complement of mobile learning functions, students would be capable of completing courses of instruction entirely on their mobile devices. An issue of concern in this paper is *ought* a college or university embark on a strategy that will enable full administrative and instructional functionality via mobile devices in an environment of resource constraints? If so, how can this be accomplished cost-effectively? If not, in which - if any - of the typical mobile learning functions should the academic institution choose to invest its limited resources in order to facilitate their accomplishment more easily on mobile devices?

III. METHOD

The Information Resources Management College (*i*College) of the National Defense University is an institution of higher learning located in Washington DC. The College offers a graduate degree and certificate programs that prepare federal government leaders to better leverage information and information technology for strategic advantage [16]. The iCollege is considering policies and support programs to better accommodate the use of mobile devices by its students. However, in a period of severe fiscal budget cutting by government organizations, discretionary resources available to the College are quite limited.

A. Design

Cartman and Ting [9] suggest that a mobile interaction design process begin with user research to better understand their patterns of use of mobile devices so adaptive strategies might be applied. To this end, the *i*College conducted exploratory survey research of its registered students to help inform the College on appropriate policies for accommodating mobile devices within its academic programs. The survey consisted of four parts:

1. Importance of Mobile Learning Functions

Each of the ten common mobile learning functions discussed above were listed with a four-point ordinal scale on "Importance" ranging from *Vital* to *Unimportant*. Explanatory comments were elicited.

2. Experience with Mobile Learning Functions

The ten mobile learning functions were again listed but the scale provided related to "Ease of Use" which ranged from *Very Easy* to *Very Difficult* in four points. A fifth option was included for *Don't know; never tried*. Explanatory comments were elicited along with a request for any special apps used in conjunction with the various mobile learning functions.

3. Recommended Mobile Learning Strategy

Respondents were asked which of three strategies the iCollege should take during the next few years in regard to mobile learning (i.e., to what extent should it invest its limited resources in mobile learning):

- *Leave things as they are*: Don't make any changes to what the iCollege is currently doing now in regard to mobile learning other than, perhaps, to make faculty and students more aware of how existing capabilities of mobile devices can be used to supplement current academic and administrative practices. No help desk service is provided specifically for mobile learning.

- *Pick and choose special capabilities to develop*: Invest resources into the development and support of selected academic or administrative capabilities that will enable mobile users to accomplish them more easily on their mobile devices.

- *Enable full administrative and instructional functionality via mobile devices*: Invest sufficient resources so that a student may elect to register for and complete an entire course only using their mobile device. Includes help desk support. The use of mobile devices in the course would be optional.

4. Your Mobile Device(s)

Information was elicited on the respondents' primary mobile device and secondary mobile device, if any, including its *type, brand & model, ownership, years of use, service provider, included features*, and those *features they use comfortably*.

The initial survey items were based on a review of the literature and a focus group of students in attendance at the iCollege. A draft survey was constructed and tested with the author's online class. Items were revised based on student comments related to their survey experience.

B. Sample

Virtually all of the iCollege students occupy middle management positions in the federal government with about 20 percent in military services. All have at least a bachelor degree and approximately 60 percent possess graduate degrees. They typically range in age from 35 to 50. With regard to the mobile devices of the respondents:

- About two-thirds of the respondents use a *smart phone* as their primary mobile device, 27 percent use a *tablet computer*, and six percent an *eReader*. For smart phone users, 45.5 percent use an Android phone, 36.3 percent use an iPhone, and 18.2 percent a Blackberry as their primary device. For tablet

users, almost all use an iPad. For users of eReaders, about 50 percent more use a Kindle than a Nook.

- The vast majority of respondents use a personally-owned device (86.2 percent) rather than an organization-furnished device as their primary mobile device. A similar percentage applies to their secondary mobile device.
- On the average, the respondents have almost three years' experience using their primary mobile device or its equivalent.
- AT&T (35.8 percent) and Verizon (33.0 percent) comprise about two-thirds of respondents' service providers. The remaining third includes Sprint (13.2 percent), T-Mobile (4.7 percent), and other ISPs (13.2 percent) such as Comcast, Roadrunner, Time Warner, Virgin Mobile, and public Wi-Fi sites.
- Almost all the primary mobile devices used by respondents allow Internet access (97.2 percent). The vast majority (i.e., more than 80 percent) include features for voice, texting, uploading and downloading. Slightly less than 80 percent include a GPS and a camera.
- The vast majority of respondents (i.e., over 95 percent) are comfortable using all the features of their primary mobile devices, especially voice, texting, and Internet access. Fewer respondents (76.4 percent) were comfortable uploading content using their mobile device.

C. Data Collection

The Mobile Learning survey was distributed in April 2012 to approximately 1200 email addresses of all iCollege registered students at the time. The email included a link to the online survey hosted by SNAP Surveys. About two hundred of the email addresses used were to either outdated or duplicated addresses. A little over 220 responses (i.e., roughly a 22% response rate) were received but a few were disqualified since the respondents indicated they did not make use of a mobile device. Student responses were downloaded and entered into an SPSS database for analysis.

D. Data Analysis

A frequency distribution was run for each scaled item in the survey using the given options and, as shown in Figure 1, for collapsed 2-point scales of the four-point scaled items related to the *Importance* and *Ease-of-Use* of the ten mobile learning functions.

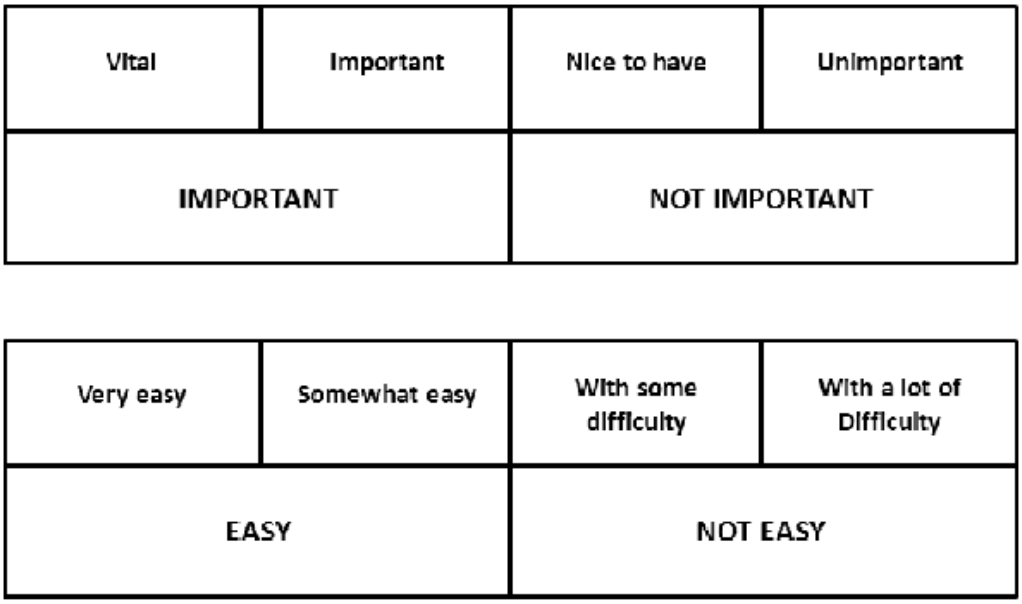

Figure 1: Collapsing of Importance and Ease-of-Use item scales for selected data analysis procedures

Cross-tabulations were conducted on the scaled item in Parts 1: *Importance of Mobile Learning Functions*, Part 2: *Experience with Mobile Learning Functions*, and Part 3: *Recommended Mobile Learning Strategy* with the *primary type of mobile device* used by the respondents. The qualitative comments elicited in the survey were reviewed individually by item and, when deemed appropriate, associated with the *primary type of mobile device* used by the respondents.

IV. RESULTS

A. Respondent Recommendations for an iCollege Mobile Learning Strategy

In Part 3 of the survey, respondents were asked which of three strategies the iCollege should take during the next few years in regard to mobile learning (i.e., to what extent should it invest its limited resources in mobile learning). There were three choices: (1) *Leave things as they are*; (2) *Pick and choose special capabilities to develop*; and (3) *Enable full administrative and instructional functionality via mobile devices*.

The far and away favorite strategy by the respondents (60.8%) was "Pick and choose special capabilities to develop." Here are a few of the many comments students offered for choosing this strategy:

- *I believe having the choice to access using a computer or mobile device gives me flexibility and can do more things. For instance, if I'm waiting in the doctor's office, I can look up class information using my mobile device, I find that time well spent.*
- *If we wait to do everything and integrate it in an immediate effort there will be show stoppers. Need to start with the Low Hanging Fruit and have a plan of progression to make this viable. Stagnation should not be a course of action for an iCollege.*
- *Personally I am most concerned with features that enhance the classroom experience. Getting the reading material available to mobile devices is first, second is any interaction capability to work with the instructor and classmates while on the go.*
- *I suggest investing resources gradually, while the technology evolves. The purpose is to give the iCollege experience and lessons learned while the technology base changes and improves.*

The second most popular strategy favored by respondents was "Enable full administrative and instructional functionality via mobile devices" but its percentage was half of the most popular choice (30.4%). The following are a few of the comments by respondents to explain their choice of this strategy:

- *It's where everything is going, less desktop, more mobile. Plus, if you wish to capture the younger students, they don't really use desktops anymore.*
- *This is what the top Universities in the country are currently doing. If you don't get in the game, the iCollege will become irrelevant in the next generation of computing (mobile).*
- *The iCollege is teaching information leaders/future information leaders, and should enable use of cutting edge technologies.*
- *The future is mobile. You are already behind.*

By far, the least popular choice was "Leave things as they are" (8.8%). Here's how some of the respondents justified this choice:

- *I don't think that special apps are needed to access courses and materials through mobile devices. Most mobile devices have internet capabilities and as long as you have access to the internet, that's all you need.* [Smartphone user]
- *Keep it simple! Invest to perfect what is currently in place. Update course presentations to correspond with lectures, more case study instruction, more assistance to professors with updating their materials…*

- *I'm not sure the mobile market is significantly developed enough yet. Additionally, there would be the added challenge of choosing a format or being compatible with all of them. I think the money could be better spent improving Blackboard.*

The choice of a mobile learning strategy seemed to be influenced somewhat by the respondents' primary mobile device. As previously mentioned, only 8.8% of all respondents recommended *leaving things as they are*, but 23% of respondents whose primary mobile device was an eReader made this choice. Only 3.4% of tablet computer users chose this strategy. Also, the majority of respondents that use smartphones and tablet computers recommended *picking and choosing special capabilities to develop* as the best strategy (63% and 59% respectively), but only 38.5% of users of eReader made this selection).

B. Importance of Mobile Learning Functions

The rank order of *Importance* of the ten mobile learning functions offered to the students is shown in Table 1. The percentage figure represents the percent of respondents that marked either "Vital" or "Important" (i.e., the other options were "Nice to have" and "Unimportant"):

A. RANK	B. ITEM	C. PERCENTAGE
D. 1	E. Alerts: *Receive alerts and reminders about assignments and appointments concerning the course I am taking*	F. 82.6
G. 2	H. Communicate: *Communicate individually with faculty, an advisor, or other students using voice, email, or text messaging*	I. 81.2
J. 3	K. Discuss: *Post or reply to items in a poll, discussion board, or other application*	L. 77.9
M. 4	N. Search Web: *Search for and access course-related web-based information*	O. 75.9
P. 5	Q. Download: *Download and review lesson materials from a course I am taking*	R. 75.7
S. 6	T. Administration: *Review administrative information about a course I am taking or thinking about taking (e.g., syllabus, faculty bio, my grades)*	U. 67.0
V. 7	W. Search Library: *Search for and review materials in the university library*	X. 56.9
Y. 8	Z. Upload: *Upload items I record with my mobile device*	AA. 54.1
BB.9	CC. Live Interaction: *Interact during live instructional sessions (e.g., webinars, simulations)*	DD. 53.7
EE. 1O	FF. Reg-Withdraw: *Register or withdraw from a course*	GG. 39.4

Table 1: Rank order of *importance* of the ten mobile learning functions

When the combination of mobile learning functions marked either "Vital" or "Important" is cross-tabulated with the type of primary mobile device used by the respondent, a number of the relationships were statistically significant at the .05 level:

- Alerts: Importance was judged higher for users of smart phones (82%) and tablet computers (90%) than for users of eReaders (54%).
- Communicate: Importance was judged higher for users of smart phones (80%) and tablet computers (90%) than for users of eReaders (54%).
- Discuss: Importance was judged highest for users of tablet computers (92%), then smart phones (75%), and then eReaders (54%).

- Download: Importance was judged higher for users of tablet computers (90%) than for users of either smart phones (71%) or eReaders (77%).
- Search Library: Importance was judged higher for users of eReaders (68%) and tablet computers (73%) than for users of smart phones (49%).

Here are some comments from respondents explaining their rating of importance of the mobile learning features:

- *The last thing we need is more electronic gadgets in a classroom to compete with the instructor.*
- *Mobile devices are nice but due to their screen size and lack of full size key board, I find that anything other than "viewing" material is too difficult to do on a mobile device.*
- *I would love to have marked all of these functionalities as "vital". However, due to the disabling of several features on my government-issued Blackberry, I cannot gain access to those features I marked "unimportant".*
- *My personal smartphone's web browsing capability is rather slow, so I don't do much from the phone. However, utilizing the Kindle or reader app to review documents would be great. Texting is also great for coordinating among students and communicating.*
- *Some of my responses were based on the way that I currently use mobile technologies. However, I anticipate that my dependence on mobile devices for learning and communication will increase exponentially.*
- *I only have a smart phone right now. The screen is generally too small for anything but reading e-mail and general web usage. Anything requiring extensive time to read is not really suitable. If I had a tablet PC, my view might be completely different.*
- *Being able to study/review course material anywhere and anytime would be the primary benefit for me. Communication is secondary.* [Smartphone user]
- *The main goal of my mobile device would allow for me to review the course materials for a specific assignment and discuss any questions I have with my instructor. I doubt I would compose my weekly assignments (deliverables) on my mobile device.* [Tablet user]

C. Experience with Mobile Learning Functions

Table 2 displays the rank order of *ease-of-use* of the ten mobile learning functions offered to the students. The *ease-of-use* percentage figure represents the percent of respondents that have tried to apply the function on their mobile device and marked either “Very Easy” or “Mostly Easy” (i.e., the other options were “With Some Difficulty” and “With a Lot of Difficulty”). The table also lists the percentage of respondents who indicated they didn’t know or never tried to apply the mobile learning function on their mobile device:

HH. RANK	II. ITEM	JJ. EASE-OF-USE PERCENTAGE	KK. DIDN’T KNOW/ NEVER TRIED
LL. 1	MM. Communicate: *Communicate individually with faculty, an advisor, or other students using voice, email, or text messaging*	NN. 77.9	OO. 46.4
PP. 2	QQ. Alerts: *Receive alerts and reminders about assignments and appointments concerning the course I am taking*	RR.72.3	SS. 51.7
TT. 3	UU. Search Web: *Search for and access*	VV. 64.9	WW. 45.7

	course-related web-based information		
XX. 4	YY. Administration: *Review administrative information about a course I am taking or thinking about taking (e.g., syllabus, faculty bio, my grades)*	ZZ. 60.2	AAA. 51.0
BBB. 5	CCC. Live Interaction: *Interact during live instructional sessions (e.g., webinars, simulations)*	DDD. 48.3	EEE. 71.4
FFF. 6	GGG. Discuss: *Post or reply to items in a poll, discussion board, or other application*	HHH. 46.7	III. 50.0
JJJ. 7	KKK. Search Library: *Search for and review materials in the university library*	LLL. 43.6	MMM. 62.9
NNN. 8	OOO. Download: *Download and review lesson materials from a course I am taking*	PPP. 41.6	QQQ. 46.4
RRR. 9	SSS. Reg-Withdraw: *Register or withdraw from a course*	TTT. 38.6	UUU. 66.8
VVV. 1O	WWW. Upload: *Upload items I record with my mobile device*	XXX. 35.1	YYY. 63.5

Table 2: Rank order of *Ease-of-use* of the ten mobile learning functions

There were a few interesting relationships between the rank order of *Importance* and the rank order of *Ease-of-Use*. The two most important functionalities (i.e., "Alerts" and "Communicate") were also deemed easiest to use. The functionality of "Search Web" was also ranked relatively high on both scales. Similarly, two of the functionalities ranked towards the bottom of the *Importance* scale (i.e., "Search Library" and "Reg-Withdraw") were also low in the *Ease-of-Use* ranking. However, two functionalities ranked high in *Importance* (i.e., "Discuss" and "Download") were ranked relatively low on *Ease-of-Use*.

Surprisingly, there was no statistically significant relationship at the 0.05 level between the *ease-of-use* percentages for any of the functions and *the primary type of mobile device* used by the respondent. The only one that came close (i.e., it was significant at the 0.1 level) dealt with the ease of registering or withdrawing from a course where respondents who use a tablet computer were almost twice as likely as other respondents to feel the process was easy to do.

There were no statistically significant relationships between the *ease-of-use* percentages for any of the functions and the *ownership* of the primary mobile device (i.e., *personal* or *government*).

There were several statistically significant relationships (some at the 0.05 level and others at the 0.1 level) between the percentage scores of those respondents who never even tried to use a mobile learning function and the primary type of mobile device used by the respondent. In all these cases the relationship was such that the highest percentage of non-use was associated with users of eReaders followed by smartphones. Respondents with tablet computers tried to apply the mobile learning function at the higher percentage than the other devices.

Here are some comments from respondents explaining their rating of ease-of-use of the mobile learning features:

- *Blackboard is okay but getting to course material is not user friendly (mostly the readings are impossible to download or read on iPad).*
- *It is mostly easy, but I have to do it through a mobile browser which makes it difficult to navigate pages that have a lot of text with such a small screen. So my productivity is limited and my inclination to do so diminished.* [eReader user]

- *I find it very difficult to download files or access websites from my BlackBerry due to file size. I frequently receive error messages on the BlackBerry when I try to perform such downloads. In addition, the download process is slow if/when it works.*
- *Currently the Blackboard app times out when trying to upload posts or blogs, additionally there are some issues with viewing the course documents.* [eReader user]
- *I have used my iPad and iPhone for all of my courses. I've registered for classes and attempted to do my course work on them. I have a word processor and presentation app so this shouldn't be an issue, but it is always difficult interacting with Blackboard.*
- *In … Cyberlaw class, [my professor] provided MP3 files for all of his lectures. This allowed me to preview and review course material at any time or place with my Android smartphone.*

The following mobile apps were mentioned as being used on respondent devices for *i*College courses other than built-in apps such as web browsers, messaging, and email facilities:

- Adobe Reader: View and work with PDF files on mobile devices.
- Blackboard Mobile: Allows easier access to BlackBoard features on mobile devices.
- Dropbox: Upload and download photos, docs, and videos for use on mobile devices.
- Evernote: Users can take notes, capture photos, create to-do lists, record voice reminders, and make these notes completely searchable.
- GoodReader: Creates new folders; downloads, opens, organizes and re-names the files downloaded; annotates and places sticky notes on documents; zips files for emailing.
- Google Search: Search by voice or location with links to other Google apps (e.g., maps).
- iBook: Gives access to Apple's internal book store for users of Apple mobile devices. Can also add PDFs and ebooks in ePub file format to the iBook's "bookshelf."
- iCloud: Enabling sharing of files between Apple mobile devices and a "cloud" service.
- iZip: Compress files on a mobile device; open, extract, and share zip files.
- Penultimate: Drawing and writing notes on a tablet computer.
- QuickOffice HD: A word processor, a spreadsheet and a presentation program for mobile devices.
- Skype Mobile: Skype-to-Skype calls and IM with Verizon Wireless.

V. CONCLUSIONS

For an institution of higher learning with limited discretionary funding for special projects, the logical choice of a mobile learning adaption strategy is "pick and choose special capabilities to develop." The vast majority of survey respondents favored this strategy. The approach is also cost-effective as the institution can get started on the road to mobile learning with limited investments while allowing it time to learn from experience as the project progresses. In addition, mobile technology continues to change and a gradual adoption process allows the institution to adapt to the evolving environment. This strategy is consistent with the theory of Rate of Adoption that suggests an innovation goes through an initial period of slow, gradual expansion before experiencing a period of relatively dramatic and rapid growth [17].

A. Implement Selected Mobile Learning Functions

As to the issue of which special capabilities to develop, four mobile learning functions are recommended to make the institution more mobile-friendly as an initial strategy: (1) Receive alerts and reminders about assignments and appointments concerning the course being taken; (2) Communicate individually with faculty, an advisor, or other students using voice, email, or text messaging; (3) Post or reply to items in a

poll, discussion board, or other application; and (4) Download and review lesson materials from a course being taken. Functions 1 and 2 were deemed the most important ones by the *i*College survey respondents and functions 3 and 4, while considered moderately high in importance, were rated moderately low on ease-of use. In combination, these four mobile learning functions are at the heart of the pedagogy of most college courses [18] and represent the type of capabilities students would make most use of while on the go. The other mobile learning functions such as registering or withdrawing from a course, reviewing course administrative information, searching the web or library, engaging in live interaction, and uploading recorded information are typically done more infrequently and can usually wait until the student is positioned at a personal computer.

1. Alerts

To the extent that the *Alert* function is accomplished strictly by use of email, no additional support is needed by students capable of accessing email on their mobile devices. However, if alerts are to be transmitted by text messaging, the faculty would need to possess mobile devices or applications that enable this capability for themselves. The faculty would also need to collect access numbers or addresses of the mobile devices of those students desiring to receive alerts by text messaging. An alternative approach to sending alerts directly to students' mobile devices would involve establishing accounts for the course on a social media site such as Facebook or Twitter and using that facility for notifying students of impending due dates and program changes.

2. Communicate

One-to-one communication between faculty, students, and advisors can readily be accomplished by email, text messaging, and voice with users who possess smart phones provided that contact information is willingly shared among users. Users of the other types of mobile devices (i.e., tablet computers and Internet-accessible eReaders) can engage in individual course communications if they have access to webmail or can download appropriate applications that enable the use of email and text messaging on those devices.

3. Discuss

In order to participate in online classroom discussions and other collaborate activities, students typically must key in text data. However, the small built-in or graphic-display keyboards of most mobile devices do not lend themselves to extensive data entry. This might account for the relatively low *Ease-of-Use* rating by students on the survey, In response to this restriction, some institutions conducting tests of mobile learning have advocated the provision of portable keyboards to enable postings of in-depth contributions from mobile devices [14] [19] . Others have suggested making use of the voice-to-text conversion capability furnished in some mobile devices or to aurally record contributions to discussion forums and attach them as audio clips [20]. Still another possibility is to structure the discussions to sanction participation with terse postings of limited lengths.

4. Download

In part because of the difficulty students experience in downloading lesson materials to their mobile devices, two approaches have been frequently suggested for redesigning courseware to ease this function:

- *Design for small screen sizes*: Although many tablet computer screens are approximately two-thirds the diagonal dimension of smaller laptop computer displays, the screens of some tablets and most eReaders are about half that size. The screen sizes of smartphones are of course considerably smaller. Course materials designed for presentation on typical computer screens might be very difficult to read on some mobile devices, especially smartphones. To accommodate the use of mobile devices, course materials may have to be redesigned to be legible on the smaller screen sizes. This might be accomplished with less content on individual web pages and enhanced navigational aids among the increased number of smaller pages within a lesson [9]. Audio and video presentations can also be substituted for lengthy textual passages in the lesson materials [10].

- *Design for people on the go*: Downloading course materials to mobile devices is often accomplished when students have just a little time to spare. To adapt to these brief opportunities for mobile learning, some researchers have recommended redesigning course materials into smaller chunks or learning objects that can be completed within several minutes [21] [22]. Lengthy course lessons or modules would be divided into complete sub-lessons, each dealing with a specific topic and requiring some interactive application to demonstrate understanding of the topic.

B. Set Policies for Accommodating Mobile Learning

1. Limiting of Mobile Device Models

It would be beneficial to specify a limited set of popular models of mobile devices with which the redesigned course materials are compatible [23]. This policy would enable designers to take advantage of certain built-in features (e.g., touch screens, zooming) common to the selected models, avoid special applications not readily available to certain mobile devices (e.g., Flash for Apple devices), and to assure a requisite minimum screen size for the redesigned materials.

2. Managing Course Versions

Most institutions of higher learning currently offer several modes of instruction to deliver courses to students (e.g., face-to-face, online, and hybrid). Adding mobile learning to the mix of offerings would complicate course version control even further. For this reason, it is recommended that the online learning version of courseware designed for presentation on laptops and desktops be made identical to the mobile learning version. Online learning can readily accommodate less content per web page and is compatible with the use of smaller learning objects [24].

3. Offering Mobile Learning Functions

Unless the institution is in a position to provide or mandate particular mobile devices, the opportunity to make use of the mobile learning functions must be optional for students. The use of mobile devices should not be mandated for students in connection with a course.

C. Provide Support for Mobile Learning Support for Faculty

Faculty are key elements in the success of adapting mobile learning in college courses [25]. Yet, aside from a few early adopters who may have implemented one or more mobile learning functionalities in their courses, most university faculty members are likely to be hesitant to employ this innovation. Accommodating mobile learning in existing courses adds to faculty workload, and some faculty members may be concerned that their students will know much more about using the features and applications of mobile devices than they do themselves [26]. The following faculty development activities are recommended:

- Arrange for a *Mobile Learning Symposium* for faculty featuring (1) presentations by the university leadership on their goals for mobile learning; and (2) discussion sessions led by local and outside faculty on the current strategies and approaches to engaging students using mobile learning.
- Recruit a Mobile *Learning Special Interest Group* (ML-SIG) of faculty members who would be willing to meet regularly in order to pursue further knowledge and experiences with mobile learning collaboratively. If practical, provide mobile devices to members of the ML-SIG for experimentation, support their attendance at conferences devoted to the topic of mobile learning, and arrange for collaborative software tools for their use in discussing and constructing a mobile learning knowledgebase applicable to the institution.
- With the assistance of any University unit devoted to advancing the use of technology in teaching, encourage the ML-SIG to experiment with the selected mobile learning functions (i.e., Alerts, Communicate, Discuss, and Download) in their courses and document the results in the form of a faculty guide for mobile learning.

- Based on the experiences of the ML-SIG, create a faculty development course on introducing mobile learning into University courses for attendance by the remaining faculty. If at all possible, deliver much of the course via mobile learning.

1. Support for Students

Based on the survey of *i*College students, most students are quite comfortable using the features of their mobile devices. However, because of the special nature of the mobile learning policies and instructional strategies implemented by the institution, those students who opt to take advantage of the selected mobile learning functions while on the go may need technical support from time-to-time. This would be especially applicable to downloading and using any special apps necessary to accomplish a particular mobile learning function (e.g., downloading a text messaging application to a tablet computer in order to receive alerts). If at all practical, the mobile learning technical support function should be assigned to the university's existing support services for online students even if a new staff position has to be created and funded. At the very minimum, a guide for dealing with common mobile learning technical support issues should be developed and furnished to both students and faculty. The syllabi of courses with a mobile learning option must be revised to assure the opportunity to employ the selected mobile learning functions is made clear to students.

VI. ABOUT THE AUTHOR

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