Developing and Applying Smartphone Apps in Online Courses

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ABSTRACT

Online courses provide students flexible access to class at anytime and anywhere. Most online courses currently rely on computer-based delivery. However, computers still burden instructors and students with limited mobility and flexibility. To provide more convenient access to online courses, smartphones have been increasingly adopted as a mobile method to access online courses. In this paper, we share our practical experience in designing and developing a smartphone platform for accessing online courses. The main contributions of this paper include: 1) we present the main technical issues of applying smartphones to online courses; 2) we discuss several key factors of designing, developing and delivering online courses that support smartphone access.

Keywords: Online education, Mobile computing, Course development models

1. INTRODUCTION

A recent survey conducted by Ball State University (2014) shows that 73% of college students now have their own smartphones. The Educause Center for Applied Research survey (ECAR, 2010) on mobile phones in higher education states that 67% of surveyed students believe mobile devices such as smartphones, tablets, and cell phones are vital to their success in university, and it is important to use mobile devices for academic activities. The increased ubiquity of mobile devices has offered great potential opportunities to develop new applications for online education as an

instructional strategy (Gikas & Grant, 2013). Mobile applications can be created to help students access online course content, interact with instructors, and communicate with peer students (Cavus & Ibrahim, 2009; Nihalani & Mayrath, 2010). Special design of user interface are often done to facilitate the access of mobile devices and to better improve communication in teaching (Rodriguez, 2011).

A common element of learning and teaching in a conventional classroom is the communicative interactions between student-student and student-instructor (Picciano, 2002). For example, students ask questions and share comments with other students and instructors. Instructors question students and adjust examples according to student's response which gives an indication about how much the student understands the content. As these interactions are fundamental learning activities, online courses need to be designed to support these interactions (mainly student-student and student-instructor communication). Nowadays many online courses offer students the opportunity to interact with each other through discussion boards, email lists, or chat rooms. Interactions in online courses have been considered critical to the success of online courses (Picciano, 2002; Richardson & Swan, 2003; He, 2013). Many online learners often report "feeling disconnected, and experience an isolation or social exclusion that impacts on their levels of participation, satisfaction and learning" (McDonald, Noakes, Stuckey, & Nyrop, 2005). Social learning theory (Vygotsky 1978, Wenger, McDermott, & Snyder 2002) suggest that learning needs to take place in social interaction and social contexts. The effectiveness and motivation of constructing knowledge in online courses could be harmed by the lack of interaction between students and students and between students and instructors (Abdous, He & Yen, 2012). Successful and smooth student-student interaction and student-instructor interaction can greatly help students develop understanding, encourage responsibility of learning, and share learning experience with each other (Vrasidas & McIsaac, 1999). As a result, the collaboration and sharing of learning experience will further motivate students' enjoyment and involvement in online courses (He, 2011).

On the other hand, mobile devices are relatively new and constantly evolving technologies. Currently, most studies of mobile learning focus on effectiveness and mobile learning system design and use surveys and experiments as the main research methods (Wu et al., 2012). For example, Cheon, Lee, Crooks, & Song (2012) used surveys to discover student's intention of adopting mobile devices in learning. However, there is little research into 1) the design and implementation of mobile applications to improve communication between student-to-student and student-to-instructor in online courses; 2) the design and delivery of online courses by incorporating mobile device access.

The purpose of our research was to explore: 1) how to design and implement mobile application to improve higher online teaching and learning; 2) how to revise an existing online course to incorporate the mobile application into online courses to most effectively exploit the flexibility and availability that mobile devices provide. The reality is that most online courses are designed based on desktop or laptop computers and are not very accessible to mobile devices. Therefore, in this paper, we mainly address the issues of designing an online course by applying the smartphone as an additional integration tool. The main contributions of our research include: 1) we present the main technical issues of applying smartphone apps into online courses; 2) we discuss several key factors related to designing and delivering online courses with smartphones.

2. LITERATURE REVIEW

Recent decades have witnessed online courses, which are different from traditional courses in many aspects, being adopted in many universities (Yu & Yu, 2010; Tsai, Shen, & Tsai, 2011; Angelocci, Lacho & Bradley, 2008; West, 2010). Today's students are profoundly different than those of 10 years ago. Younger generations grew up with smartphones or similar mobile devices. However, it is surprising to find that so far not many related work has been done in applying mobile platforms to support online courses. According to Chan et al. (2006), because of the rapid advancement of mobile computing services and portable personal devices, mobile devices have transformed the lives of students outside the school. Today's students are "digital natives," and are known as students of the e-era (Chan et al., 2006). Mobile learning has been recognized as one of the most influential technologies for education (Johnson, Adams, & Cummins, 2012).

With the rapid development and popularity of mobile technologies, there is a strong need to make online courses accessible for mobile devices. Coupling mobile apps with smartphones, we can provide students easier access to learning materials. Using a mobile app based technology-enhanced-learning approach could create an evolution in teaching and learning through seamless learning. Another survey shows that 73% of college students have their own smartphones. Using those smartphones, students can access their course materials anytime and anywhere (Ball State University, 2014).

In MIS or CIS major, many teaching cases have been introduced. They often focus on the use of experience with certain examples but are not directly improving the communications among students and instructors (e.g. Newby & Nguyen, 2010; Mitri, 2010; Steiger, 2009; Wagner & Pant, 2010; Abrahams & Singh, 2010). We are more interested in the acceptance of online courses (Cheng, 2011; Davis, 1989). According to Richardson and Swan (2003), incorporating the social aspects of learning into both the design and delivery of online courses is much better than only presenting the information to students. Therefore, we proposed to improve online course design by adopting smartphone applications to improve student-student and student-instructor communications.

3. OUR STUDY

3.1 Research questions

The study was guided by the following research questions:

1. What are possible activities in online teaching that would be very difficult or impossible without smartphones?
2. How do we create a cooperative student-to-student environment on the basis of a smartphone platform?

How do we create an interactive student-to-instructor environment via smartphones?

3. What are the main technical challenges in terms of creating a cooperative and interactive environment? What are the possible solutions for overcoming these technical challenges?

3.2 Method

3.2.1 Overview: In traditional teaching and learning environments, computers are set up at a fixed location in the classrooms where all students and instructors perform teaching-learning tasks. Both students and instructors must present in the same classroom at the same time to conduct educational activities. Since the development of the Internet, more and more courses have been placed on the Internet. With more and more faculty members developing and teaching online courses, online course delivery has become a key alternative to face-to-face delivery (Gordon, He, & Abdous, 2009). However, computers are still used by most instructors and students in online courses. Recent years have witnessed smartphones becoming faster and more capable. Most, if not all, routine tasks can be done through smartphones. But we realize that computers are still dominant in education. Therefore, we proposed to adapt smartphone platforms for online courses, as additional access to online courses. The system diagram is shown in Figure 1. In this system, online courses are placed on an Internet Cloud. Not only computers but also smartphones can access the online courses on the cloud. This will further free users from the bondage of only using access hardware, i.e. computers.

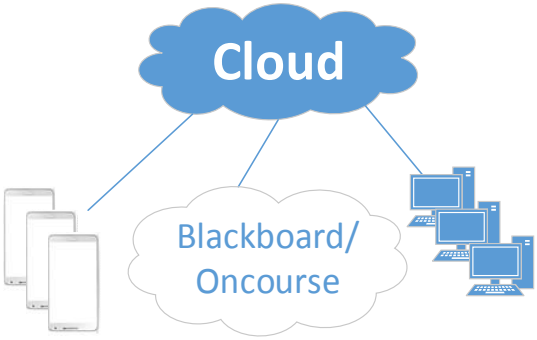


Figure 1. Both Smartphone and computers can connect online courses on Cloud.

Compared with developing applications for desktop computers, developing smartphone applications faces more technical challenges in terms of creating cooperative and interactive environments. First, the high mobility of modern society makes it harder for students to meet and study at the same time and at the same place. Therefore, developers of smartphone applications have to create an online place where students can meet simultaneously and talk about the same topic. Second, the resources (computing, communicating and storing capacity) of a smart phone are very limited, compared with a desktop computer. The screen size of the smartphone is also much smaller than a computer monitor. In this section, we present a technical solution that can solve the two challenges. As an overview, we propose a phone application design that mainly retrieves and submits data and information from cloud services where online courses are hosted. In addition, we also propose a content based interaction approach to improve "anytime and anywhere" communication. For smartphone applications to become successful, they must support and enhance various user activities and offer useful, effective functionality (Beale, 2005). Thus, we created a Peer List which shows all the students who are studying the same content at the same time. The Peer List can encourage students to share their questions/thoughts and experience/understanding of the same topic. All students who recently communicated will form a Buddy List which will continue to motivate students to further interact with each other and enhance their communication.

3.2.2 Smartphone Application Design and Implementation: Although smartphones are more powerful in computing, communicating and storing than before, smartphone applications are still "thin" client software. Oftentimes, we still have to rely on the cloud to store and process information because the cloud has more powerful computing, communicating and storing capability. From the design perspective, we mainly display information or content on smartphones although some computing tasks are involved.

Our smartphone application supports three types of roles: admin, student and faculty as shown in Figure 2. The admins are the developers for the software. They are responsible for managing the application and fixing issues related to the application. The students and the faculty are the main users. The faculty will design course-related tasks, prepare learning materials, answer questions, and give feedback to students. Most of the course activities are conducted through the course management services such as Blackboard or OnCourse. Students mainly access course content through smartphone application or computer-based browsers.

The main functions of the phone application include browsing web-based course content, playing multimedia content, and supporting peer-to-peer communication as shown in Figure 3. Browsing web-based course content can be implemented by using an embedded WebView in Android SDK if it is on Android environment. Playing multimedia content allows students to watch lecture videos. The peer-to-peer communication includes student-to-student (S-S) and student-to-instructor (S-I) interaction. The communication between peers will be provided through the cloud service daemons.

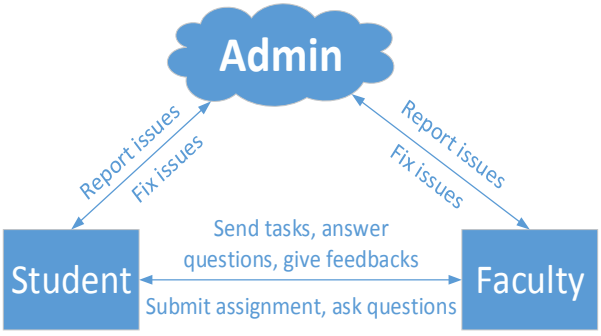


Figure 2. Roles in the application

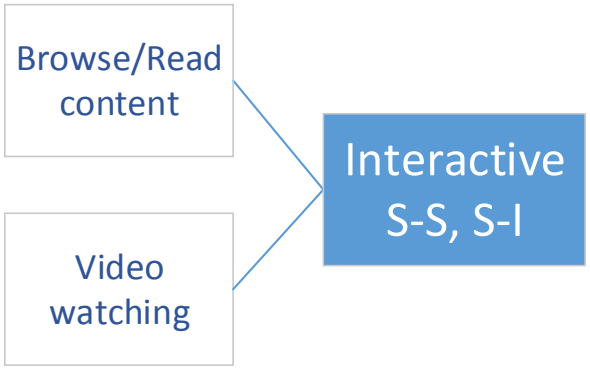


Figure 3. Main tasks of our smartphone application

The app development was done by several experienced programmers. To make the development process easier to understand, we will provide an example by describing how we developed the lecture video playing function, as shown in Figure 4 (a) and (b). We developed the application by using Java programming language. We adopted Eclipse as an integrated development environment (IDE). Eclipse IDE is a well-acknowledged software development tool which includes almost all the needed tools such as editor, compiler, and debugger, etc. For Android development, it also includes a drag and place interface design tool shown as Figure 4(b). It also provides a very useful, nice and quick way to exchange information from the application on your device and the development computer. All these tools make development a lot easier.

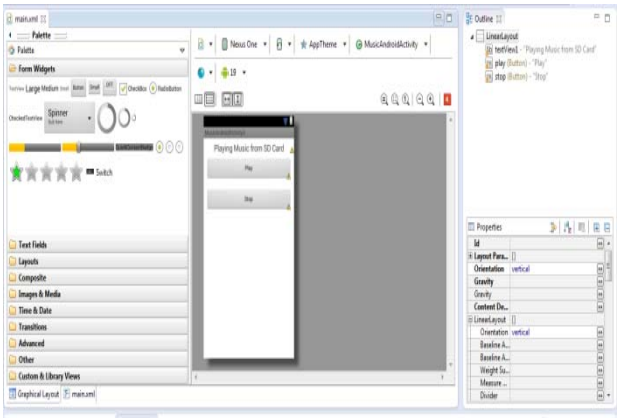
```
buttonPlay = (Button) findViewById(R.id.play);
buttonPlay.setOnClickListener(new OnClickListener() {

    public void onClick(View v) {
        mPlayer = new MediaPlayer();
        mPlayer.setAudioStreamType(AudioManager.STREAM_MUSIC);
        try {
            mPlayer.setDataSource(url);
        } catch (IllegalArgumentException e) {
            Toast.makeText(getApplicationContext(), "You might not set the URI correctly!", Toast.LENGTH_LONG).show();
        } catch (SecurityException e) {
            Toast.makeText(getApplicationContext(), "You might not set the URI correctly!", Toast.LENGTH_LONG).show();
        } catch (IllegalStateException e) {
            Toast.makeText(getApplicationContext(), "You might not set the URI correctly!", Toast.LENGTH_LONG).show();
        } catch (IOException e) {
            e.printStackTrace();
        }
        try {
            mPlayer.prepare();
        } catch (IllegalStateException e) {
            Toast.makeText(getApplicationContext(), "You might not set the URI correctly!", Toast.LENGTH_LONG).show();
        } catch (IOException e) {
            Toast.makeText(getApplicationContext(), "You might not set the URI correctly!", Toast.LENGTH_LONG).show();
        }
        mPlayer.start();
    }
});

buttonStop = (Button) findViewById(R.id.stop);
buttonStop.setOnClickListener(new OnClickListener() {

    public void onClick(View v) {
        // TODO Auto-generated method stub
        if(mPlayer!=null && mPlayer.isPlaying()){
            mPlayer.stop();
        }
    }
});
```

(a) Sample code of video play



(b) Sample interface layout of video play

Figure 4. Sample implementation tools and environment

3.3 Content-based Interaction

We assume that students who are learning the same content could be the ideal student peers for communication and interaction because they face the same learning topic. Therefore, we constructed a peer list to help initiate the interaction to support their discussion on the same learning topic. In this section, we use an online video lecture as an example to explain how this function can be done. We first taped the class lecture and placed the video on an Internet cloud. The lecture video clips can be accessed by phones as shown in Figure 5. As the content of a lecture tape can be more than one hour, we made "check points" of the video. A check point is a screenshot of the video at every 3 minutes. The check points screen shots are placed right underneath the video. When a student feels confident about understanding the content, the student can click the next few check point screenshots to skip the content that has already been understood. Similarly, if the student does not understand the content, the student can rewind back and view the content multiple times.

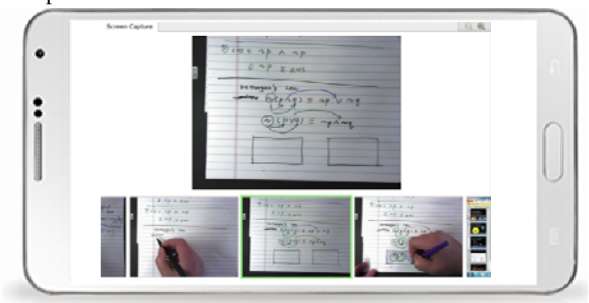


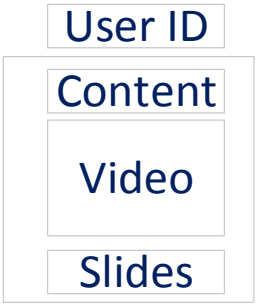
Figure 5. Lecture videos can be selected by "check point" screenshot

We also placed interactive message boxes for every lecture video as shown in Figure 6. When a student is watching a lecture video, comments and questions can be placed. The comments and questions will be shared to all the students in this online class and simultaneously be pushed to all the users who are watching the lecture.

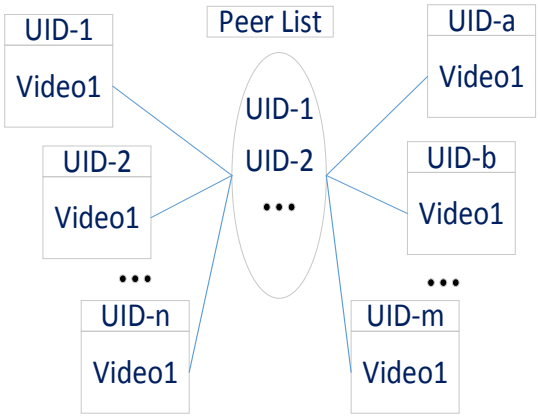
Figure 6. Comments placed and shared by students

Online class content includes user information, content details, video and slides information. The user information is simply presented by user id as shown in Figure 7(a). The content details are composed of course information. Video clips are the slides that are captured when the instructor prepares the online class. The students can watch the video by clicking it.

The users who are watching the same content can form a peer list as shown in Figure 7(b). This Peer List is dynamically updated to reflect the actual users. The instructor of the course will be added to every Peer List. The Peer List can match study peers who are studying the same content at the same time. The Peer List can greatly expose and engage students and instructors to and in the study process. For example, a student is watching "video 1" as shown in Figure 7. This student's watching content and the user identity (UID) will be pushed to all the other students who are watching video 1 at the same time. The student will receive a list of other students who are studying the same content. As buddies, they can discuss the content and ask questions, etc.



(a) The structure of content and user information



(b) A Peer List can be made to link students who are doing the same activities

Figure 7. Data structure used to connect students who are doing the same activities

Once students are on the same Peer List, they can simply click another student's name and start to talk with each other (by voice or by text). All the names of students that have recently been communicated with will form a new list: Buddy List. This is based on another assumption that these students may have the same learning pace and may stay on the same learning topics at a particular week. Again, the instructor of the online course is a member of all Buddy Lists. The Buddy List shows not only the user's information, such as names and headshots, but also the current status and the equipment that a user can use right now, as shown in Figure 8. There are several statuses: online, away and idle. Not all phones have cameras and not all users want to use cameras for video calls. Therefore, we offer call support for two devices: video call and phone call. The Buddy List is designed to make it easier for students to find a study partner and share the learning experience and thoughts about the topics with their peers.

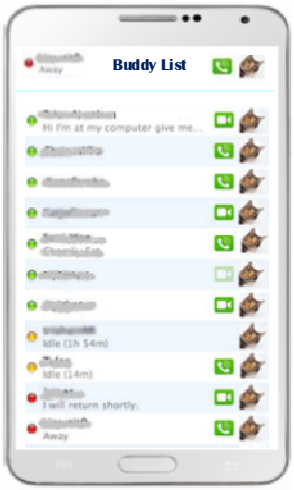


Figure 8. Buddy lists

3.4 Online Course Design

We designed a mobile-enhanced online course based on the following steps:

1. Determine the goals for the course;
2. Set the class schedule and agenda;
3. Set the online class protocol;
4. Determine how to assess and provide feedback to the students;
5. Determine the level of mobile involvement;
6. Establish and test phone connection and collaborative interaction;
7. Provide feedback to students and obtain feedback from students.

We list temporal sequence of the steps, which is used to support online courses supported by smart phone application. The orders can be changed according to the specific course needs or situation. In this paper, we show the steps in the order listed.

1) Determine the goals

In our university, the goals of a course have already been stated in the course catalog. But there is still much room for the assigned instructor to decide which goals to be emphasized and how to achieve these goals. The goal of applying smartphones into online courses is to improve the student-student communication and instructor-student communication and to ultimately improve learning.

To show how a goal can be achieved, we use an information security concept as a case study. In the case study, we want to illustrate the main Information Security attributes or qualities, i.e., Confidentiality, Integrity and Availability (CIA) (Yan, Olariu, & Weigle, 2009). The CIA model is the general practice of protecting information from unauthorized access, use, disclosure, inspection, modification, disruption, perusal, recording or destruction. The goal of the case study is to help students understand the definition of CIA and the basic principles. We can use smartphone application to show the lecture video and then give several security cases to illustrate the concepts and principles of confidentiality, integrity and availability. A smartphone application can simulate an online credit card transaction. For example, a credit card transaction over mobile platform must keep the credit card information confidential to avoid account information leakage. For integrity, the same credit card transaction must not be altered by any parties. For availability, the same credit card transaction must be available no matter which brand phone and which phone service carrier the phone user is using and where the phone user is located.

2) Set the class schedule and agenda

Online courses are usually flexible on class schedule of the semester during which courses are offered. Therefore, online course instructors could prepare an online course by considering the sequence of topics. There may be some deadlines by which all students are supposed to complete some required learning activities.

In our class, we have weekly report about the class progress. Students will have to submit a report about each week's learning activities. The instructor can also monitor each student's learning activities by checking the online content access records either through computers or smartphones.

On the first day of the class, the class agenda will need to be posted online so that students will know what contents will be covered and what activities will be expected. For most online learning units, there will be a 40-60 minute pre-taped video, 10-20 minute examples, and several illustration applications. The student-student and student-instructor communication will be placed as questions and answers.

3) Set the online class protocol

As opposed to traditional courses, online courses rely on the protocol setups (Kennedy, Nowak, Raghuraman, Thomas, & Davis, 2000). The online class protocols are the guidelines that help students understand the instructor expectations. The right protocol will help the class to go more smoothly. For example, late assignment is not accepted and will result in a lower overall grade. Video lecture, module reading, discussion posting and email content must be kept up. If discussion topics are given, the deadlines for the discussion post and responses could be specified for each topic. For online courses with smartphones, it is a lot easier to check the new posts and to respond to the posts.

4) Determine how to assess and provide feedback to the students;

In our class, we provided students two ways to access the online courses: computers and smartphones. For example, students can navigate the lecture video by using smartphones. The video clips are placed on the cloud. As the online class content is placed on a server that has 100 Mbps network bandwidth. The class size is about 20-30 students. There is no problem to provide the video streaming simultaneously. Smartphones can also operate the course management service, such as Blackboard and OnCourse, which is developed by Indiana University and adopted by many universities. Currently most operations that computers can do can also be done through a smartphone. The access from smartphones can offer more flexibility and mobility than the access from computers.

5) Determine the level of mobile involvement;

The comparison of the access from smartphones and the one from computers indicates the level of mobile involvement. As smartphone is a lot smaller than a computer, therefore typing a large paragraph statement or even a full length paper could be very time consuming. On the other hand, responding to one or multiple lines of comments, questions, and providing answers through smartphones can be very easy. Computers also have much more precise pointing device than smartphones have. Therefore, operations that require more detailed and precise pointing may not be applied to smartphones.

In our class, we involve several learning activities for smartphone access. For example, pre-taped lecture video can be easily played from smartphones because we only designed one play button. Online discussion board is another good example because students only need to type a few words using smartphones. Reading content and checking grades are also made easier for mobile access.

6) Establish and test phone connection and collaborative interaction;
As mobile phone access provides great mobility and flexibility, we consider it as an important way to access online courses. At the beginning of every class, we need to establish and test the phone connection to online courses in order to ensure that it works properly. The connection can go wrong at many possible parts. For example, a phone may need to install the correct application to access the online class more efficiently. The services on the cloud may be not correctly set up as expected. In our sample courses, we host online courses using course management web services (Blackboard). All the online class content can be well-maintained and easily found through the course management web services.

7) Provide feedback to students and obtain feedback from students.
Giving feedback to students is relatively easy if the online course is located on a course management system. Normally, the feedback to students should be partitioned into several categories and should be provided to students gradually.

Collecting feedback from students is important to instructors' online teaching and will further benefit students in learning after the instructors adjust online course design and delivery (Richardson & Swan, 2003). The final student evaluation is a method of gathering anonymous feedback from students about what effective teaching methods are, what method helps them learn and what does not. We are particularly interested in collecting feedback during the class so that we can adjust the teaching according to the feedback and suggestions from students. One way of gathering feedback from students is to let students take a few minutes to complete a feedback form anonymously during or after an online exam.. A feedback form can contain a mix of open-ended questions and quantitative Likert scale questions. The Likert scale questions will allow students to rate on a number of issues. The open-ended questions can be used to learn about positive and negative aspects of the online course and solicit suggestions that can improve the online course. This kind of in-exam feedback forms typically have high response rate. But the disadvantage is that the answers might not be honest because students might worry that instructors may recognize who they are.

Another way to collect feedback from students is to have them complete a random and anonymous online survey about the class. Instructors can design course-specific online surveys to solicit student feedback in order to improve the course. The advantage of using an anonymous online survey is that students are more likely to provide honest answers and can fill it out anytime and anywhere. The disadvantage is that the response rate might be low unless the instructor provides the students with some incentive to fill out the survey.

3.5 Evaluation Results

3.5.1 Data Source: We designed a user survey to examine the perceived effects of students using smartphone application in an online computing course. Table 1 shows two main categories of questions used in the evaluation. A five-point Likert quantitative survey (1 for "strongly disagree", 2 for "disagree", 3 for "not sure", 4 for "agree", and 5 for "strongly agree") was used to evaluate the effectiveness of the proposed method. We were particularly interested in how students perceived the function and ease-of-use of the smartphone application. In addition, three qualitative survey questions were designed to help us better understand students' learning experience with the use of smartphone application for online education (see Appendix). The first open-ended question was used to understand how the phone application supports students' learning in the class. The second and the third questions were to understand how the phone application supports the interaction between peers and between a student and an instructor.

Questions	Quantitative questions	Qualitative questions
Perception	#1,#3,#6, #7,#9	#1
Function	#2,#4,#5,#8	#2,#3

Table 1. Data source

3.5.2 Data Collection and Data Analysis: An online survey was managed and delivered to undergraduate students by the authors. The survey questions were given to students in an online exam as appendix questions. The survey questions will pop up when students submit the exam answers. The estimation finish time of the survey is about 10 minutes. Totally there were 32 students who completed the survey. We conducted descriptive statistical analysis (mainly frequency) for the nine quantitative survey questions (see table 1 and Appendix). Using frequency values allowed us to analyze the effectiveness and calculated the percentage of each category of their responses (see Table 2). We combined "strongly agree" and "agree" together as "Agree", likewise "strongly disagree" and "disagree" as "Disagree". The qualitative data analysis was done by summarizing and synthesizing student's comments and feedbacks to the open-ended survey questions.

After the quantitative survey data was processed and analyzed, we generated an evaluation result table (see Table 2). Table 2 shows that at least 84.4% students were positive of the smart application in supporting online learning. For question #1, 93.8% students agreed that the smartphone system was easy to use. For question #3, about 84.4% students agreed that they checked the material from phone more often than they checked from computer. Regarding question #6, 87.5% students saved time and efforts after using the smartphone application. For question #7, 93.8% students enjoyed the flexibility (anytime and anywhere) of using phone application to access the class material. As for question #9, 93.8% students found smartphone application made the process of contacting the instructor faster and easier. The peer communication provided by the phone application improved 90.6% students' understanding of the class, shown by the question #2. There are about 87.5% students, as shown in the question #4, felt that the phone application helped the development of a class community. As for question #5, 93.8% of students felt that the use of the

Peer List function was an effective tool for learning course material. The question #8 shows that 87.5% students were satisfied that they can use smartphone application to share comments with classmates.

Theme	item	Disagree		Not sure		Agree	
		f	%	f	%	f	%
Perception	#1	2	6.3	0	0.0	30	93.8
	#3	1	3.1	4	12.5	27	84.4
	#6	1	3.1	3	9.4	28	87.5
	#7	0	0.0	2	6.3	30	93.8
	#9	1	3.1	1	3.1	30	93.8
Functions	#2	3	9.4	0	0.0	29	90.6
	#4	2	6.3	2	6.3	28	87.5
	#5	1	3.1	1	3.1	30	93.8
	#8	1	3.1	3	9.4	28	87.5

Table 2. Evaluation results

The qualitative open-ended survey questions provide us comments about the proposed system. Some representative comments from students are listed below:
"I enjoyed watching the slides and the online videos from my phone when I was waiting for bus."

"I like the fact that we could ask questions and participating directly from my phone."

"The power point on phone helps me make good notes."

"Being able to directly apply what I am learning in class on the homework is something I like, as well as the teaching style and test preparation over phone."

We also received some complaints about the mobile application. For example, a few students mentioned, "Not everyone can read size 10 font" and "the video play took too much CPU resources of my phone." These complaints provide directions on how to improve our mobile application and how we could make online courses more accessible for mobile devices. A limitation with the evaluation is that the sample size is small. We hope to conduct a large-scale evaluation with more classes in the future to get more input from online students in terms of better improving the smartphone application for online learning.

4. CONCLUSIONS

The increasing popularity of the online course format has gradually obtained the growing impact to information system education. But many instructors and students are still tied to computers which are not very mobile. With observation that most students in the U.S. currently have smartphones and they frequently use the smartphone as their main communicating tools, we proposed to develop and apply smartphone application to motivate and improve student-student and student-instructor interaction in the online courses. We believe that online courses should be designed to provide conventional computer-based access as well as the mobile smartphone-based access. A typical online course includes information such as: lecture notes/slides, tutorial questions and answers, online quizzes, lecture videos and practical exercises. In this paper, we use a lecture video as an example to show the methods that engage student-student and student-instructor interaction with smartphones. We illustrated how the students who are watching the video content can be connected by other students and instructors who are watching the same content. The smartphone application can also share the current status of students in an online class. The status sharing feature can be used to engage students to further discuss the course content. These technologies are employed to create more mobile access that is available anytime and anywhere.

The significant contributions of this paper include the following. First, it provides a new and mobile access to online courses. This will further free online courses from computer constraints. Using smartphones, students and instructors can access and operate on the online class with much higher mobility and flexibility. Second, it shows that higher engagement and easier operation can be provided to students through smartphone applications. The feedback we received clearly showed that students are more interested in participating in the online class that supports phone access. Third, we presented a possible solution and interface design of a mobile application that can encourage more student engagement in online courses.

As for future research, we will continue to improve the smartphone application based on the feedback we collected from students. We will enhance the security features of Smartphone applications (Chen & He, 2013) and further evaluate the effects of mobile learning and the influence of learner characteristics in the mobile learning process (Wu et al., 2012).

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APPENDIX

Smartphone application for online class survey

1 It was easy to use the phone application.
2 The peer communication helped me understand class better.
3 I check my class material from phone application more often than from computer.
4 Using the phone application fostered a sense of classroom community.
5 The use of the Peer List function is an effective tool for learning material.
6 The use of the phone application reduced my time and effort in the class.
7 I am satisfied with using the phone application to check grades.
8 I am satisfied with using phone application to share our comments.
9 I felt that smartphone application made the process of contacting the instructor faster and easier.

Open-ended questions

1 How did the phone application help you learn in the classes?
2 How did your peers help you understand the lecture videos?
3 How did the phone application help you communicate with the instructor?

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