

Mobile Technology Integration into Teaching and Learning

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Abstract. Rapid development of mobile technologies offers various types of mobile devices, such as a mobile phone. The mobile phone is a device that almost every student has in Indonesia, since it is affordable for all. It has a great impact on learning. Currently, the integration of mobile technology into teaching and learning has been increasing, due to the capabilities of a mobile phone will gradually overtake the computer's functions especially for retrieving information as learning resources. The web address or URL of the resources sometimes too long and unable to memorize nor to write them. The purpose of the research is to utilize the QR code to support mobile learning. The research conducted in the Educational Technology Department, State University of Malang, Indonesia. The result of the research revealed the students gave the positive responds to mobile learning and the utilization of QR code that helped them to retrieve the online learning resources.

Key-Words: *Mobile Learning, Mobile phone, QR Codes*

1. Introduction

Nowadays, the development of mobile technologies is growing rapidly. It offers various types of devices such as mobile phone, laptop, iPad, iPod/mp3 player, PDA and other technologies. However, amongst these mobile technologies, mobile phones are one of the fastest growing technology-based industries in the world. The number of mobile phone users has increased rapidly in the entire world. In Indonesia, the number of mobile phone's subscriber as 2011 reached 178 million with total population 237 million, it means some of them carry more than one mobile phone and it is owned by blue collar workers, house wives until white collar/professionals. There are various types and brands of mobile phones are offered in Indonesian market at affordable prices, from featured phone until smartphone types.

In the Nielson Company's blog, Viraj Juthani, Director Telecom Practice Group, The Nielsen Company, Indonesia said "*The Indonesian telecommunications market is unique. While consumers in most country's progress from 'no connections' to adopting landlines and subsequently cellular or mobile devices, consumers in Indonesia have mostly headed straight to mobile phones as their communication tool. This is a key reason why landlines or fixed lines have never really taken off in the country, with penetration remaining relatively flat over the years*". In contrast, the penetration of 48 percent of Internet users in Indonesia used a mobile phone to access the Internet, whereas another 13 percent used other handheld multimedia devices, the highest dependence on mobile Internet access in Southeast Asia [1].

The primary function of a mobile phone is as a voice communication tool, however the rapid growth of the mobile technology have changed the function not merely as a communication tool, but mobile technologies are becoming more embedded, ubiquitous and networked, with enhanced capabilities for entertainments, social interactions and internet connections. Everyone who carries a mobile phone can do tasks while on the move for examples, connecting each others, accessing mobile banking, listening to the music, watching a video, taking a picture, audio/video recording, exploring the world and so on and any new software applications can be installed on a mobile phone for enhancing its capabilities.

Since entering a mobile age era, mobile phone has become a pervasive technology in the world. It is integrated into human's daily life. Mobile phones are carried everywhere and some carry mobile phone all the time. Today's younger generations are addicted to mobile phones, indeed Some said they feel so bereft without their iPhone or Blackberry that it evokes similar feelings to the "phantom limb" syndrome suffered by amputees [2]. If they forget to carry their mobile phone, they become unable to focus their mind and the psychologists describe the symptom as the typical newly-emerged mental disorder known as mobile phone addiction or 'mobile phone dependence.

1.1 Mobile Learning

The increasing of the capabilities of a mobile phone will gradually overtake the computer's functions especially for retrieving information resources. The mobile phone has a great impact on learning, learner's motivation, collaboration and mobility. The rapidly increasing mobile phone users in the world become potential opportunity for using it as learning media tools, especially for developing countries in remote areas. Mobile technologies are revolutionizing education, transforming the traditional ways of learning and teaching into 'anytime' and particularly, 'anyplace' education.

Japanese researchers use the concepts pervasive learning and ubiquitous learning, rather than mobile learning, to emphasize that mobile device often are applied in learning situations taking place in a place directly related to the object of learning, often, mobile learning is organized as collaborative learning focusing on sharing knowledge and social knowledge building [3]. In considering the implementation of mobile learning,[4] suggests five broad categories of technology that should be considered, namely transport, platform, delivery, media technologies, and development languages, as seen in Figure 1.

[4] Also describes the benefits of mobile learning, such as: mobile learning helps learners to improve their literacy and numeracy skills; mobile learning encourages collaborative learning; mobile learning helps to promote informal learning and so on. [6] explain that mobile technology extends learning beyond the walls of classrooms and give some benefits for learners, parents and teachers with regard to the impact of wireless technologies on portability, collaboration and motivation.

Synthesis of the relevant literature confirms that mobile technologies are able to support learners' engagement in creative, collaborative, critical, and communicative learning activities, but considerable diversity was found in the ways teachers and learners have used digital and mobile technologies to support these real-world practices [5]. According to [6] in their M-Learning Project 2004, they concluded that mobile phones play an increasingly important role in the lives of young adults as a communication tool, and those new services, such as games designed to improve basic skills, are of interest to young adults and the M-learning project findings show that in fact both the limits of the technology and the lack of control over how and when the learning happens implies that a different learning model is needed. The M-learning project finds that with mobile learning, learners are often surrounded by distractions such as limited screen size; therefore learning has to be engaging.

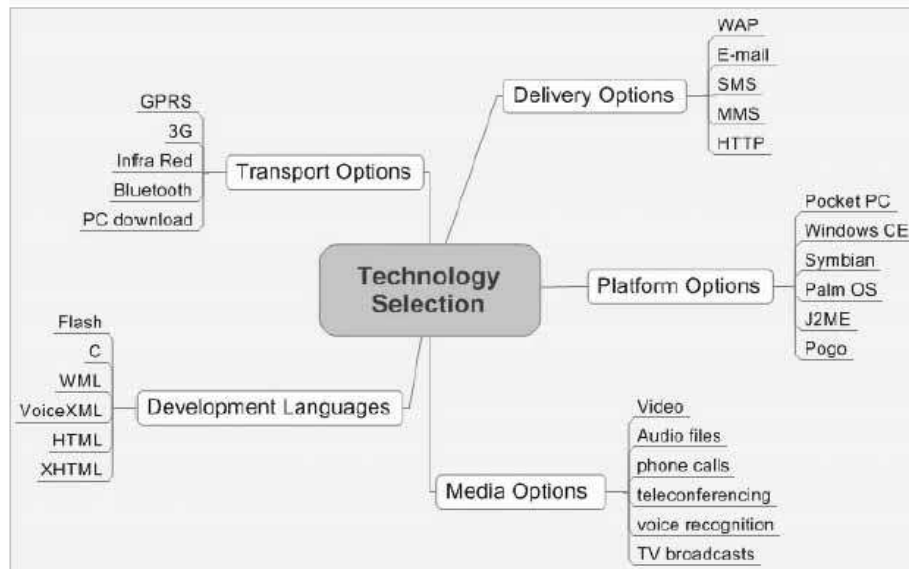


Figure 1. Technology Selection

1.2 QR Codes

QR stands for Quick Response, it is 2 dimensional bar codes. It was developed by Denso-Wave Incorporated Japan in 1994 [7]. QR code provides information that can be stored 7,089 numeric characters, 4,296 alphanumeric characters, 2,953 binary bytes, 1,817 Kanji characters or a mixture of them. It stores information in both vertical and horizontal directions, the sample figure of QR code as shown in Figure 2 [8].

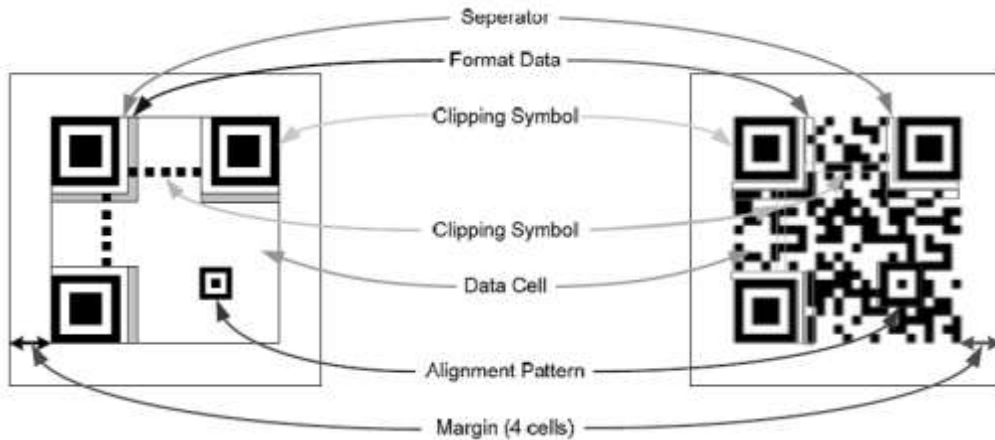


Figure 2. QR Code Model

In order to read the QR codes, a mobile phone should equip with camera and QR scanners that can be downloaded based on the mobile phone's brands or types. Data can be easily encrypted in a QR code to provide a confidentiality of information embedded in the code. It can also handle various languages. For examples, there are a number of standards adopted by Asian countries like GB/T 18284 by Chinese National Standard in 2000, KS-X ISO/IEC 18004 by Korean National Standard in 2002, and TCVN7322 by Vietnam National Standard in 2003 [9]. The QR code has multi functions, it can be used to store a long web address or URL (Uniform Resource Locator), data information and sms text. These functions can be used for education, government, business, industry and advertising purposes.

Recently, the use of QR codes in Indonesia has been increasing. It is mostly applied in mass media, commercial products, and currently the government of Indonesia had declared the use of QR codes in identity card (id card) for all Indonesian citizens. However, the uses of QRcodes in education are still small, there are only few researches that addresses the use of QRcodes in education in Indonesia, whereas a lot of benefits that offered by the QR code implementation in education. The purpose of the research is to utilize the QR code implementation for storing a longer web URL in retrieving online learning resources, formative assessment and online questionnaire in the Educational Technology department, State University of Malang, Indonesia.

2. Literature Reviews

There are a lot of literatures describe the success of the utilization of QR codes in education some of them reported the QR code implementation to engage the learners in teaching and learning, specifically it could be used to enhance the class performance. [10] Used the QR code to allow students to easily view Web pages instead of typing long web addresses (URL) and they used the QR code to allow the teacher to conduct surveys during classes; [8] reported the application on 3G mobile phone and two dimensional barcode in classroom communication support system, the QR code will be used during the attendance check, class evaluation. [11] reported a project in which students give feedback during and after a lecture on their degree of comprehension.

QR codes also can be used to support outside classroom, such as QR code usage in museum, QR codes are a great way to enhance the visitor's experience. They can bring life to exhibits, allow communication between visitors and educate at all levels [12]. Now days, a lot of museums are applying QR codes to motivate the visitors for retrieving the additional information that can guide the visitors easily.

Some of universities applied QR codes such as in The University of Bath is the forerunner of applying QR codes in education for library catalogues, students' assignment submission, The QR code contains the URL of the page on that particular Moodle course QR codes can also be found on posters around campus, on Websites and service blogs for bookmarking, in handbooks linking to activities, and in marketing materials from departments [9].

3. Research Methodology

SDLC (System Development Lyfe Cycle) methodology was used to design the framework of the system. This methodology refers to the overall process of developing information systems through a multistep process from investigation of initial requirements through analysis, design, implementation and maintenance [13]. Here are the stages in developing the framework system based on SDLC methodology:

1) Planning:

To determine the goals of the research, specifically utilizing QR codes for supporting mobile learning in enhancing the class performance. Analyzing the coverage functions of the QR codes that will be used to support mobile learning were required, such as the QR codes are used in the lecture's presentation for retrieving online learning resources, online formative assessment and online questionnaire. These tasks are accessed through mobile phones with QR codes as an intermediate technology.

2) System analysis and requirements:

In this stage, examining what software applications are available to create and store QR Codes; the preparation of QR code generator and reader, storing the documents on the server are needed. For the QR generator, the documents's URL embedded with QR codes by using Kaywa (<http://qrcode.kaywa.com/>) that is available in the internet for free. For QR reader, If the mobile phone does not build in any QR code reader, the user needs to download the right decoder from the Internet and installs it on to the mobile phone. The QR reader depends on the mobile phone type and brand. Google Docs is used to store online documents such as questionnaire and formative assessment. **Google Docs** was a free, Web-based office suite and data storage service offered by **Google**. It allowed users to create and edit documents online while collaborating in real-time with other users. Google Docs combines the features of Writely and Spreadsheets with a presentation program incorporating technology designed by Tonic Systems. Data storage of files up to 1 GB (http://en.wikipedia.org/wiki/Google_Docs).

3) System design:

The prototype of the system is divided into two schemes, namely: tutor's side for lecturer and client's side for students as shown in Figure 3.

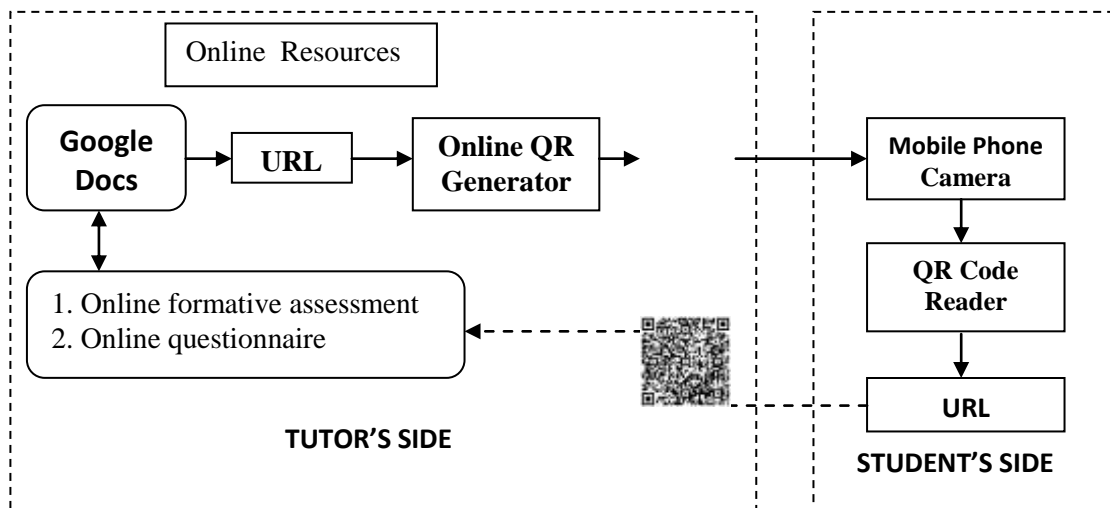


Figure 3. Mobile Learning System

Tutor's Side:

The online resource is inked to an URL, and for the formative assessment and questionnaire are created by using Google Forms. Google forms are a useful tool to help you plan events, send a survey, give students a quiz, or collect other information in an easy, streamlined way. A Google form is automatically connected to a spreadsheet with the same title. When you send or share a form, recipients' responses will automatically be collected in that spreadsheet (<http://support.google.com/docs/bin/answer.py?hl=en&answer=87809>). One form has a long URL that is unable to memorize nor to write it. The long URL is generated by using the online QR code generator to create a QR code.

Student's Side:

The mobile phone camera is directed to the QR code for capturing it. The mobile phone's QR reader that already installed or built-in will decode the code into the origin data, in this case the URL. The mobile phone's browser will directly open the URL.

4)Implementation

The research was conducted in the Educational Technology Department, Faculty of Education State University of Malang, Indonesia. There are 29 undergraduate students were engaged in the research. In order to investigate the effectiveness of the system, questionnaire was developed. After accomplishing the formative assessment, all participants were asked to complete the questionnaire for investigating their perspectives on utilizing QR code for supporting mobile learning. The questionnaire was also presented online and accessed by mobile phone.

5)Maintenance

This stage includes all the activity after the implementation is performed in order to keep the system operational. For example, for increasing the learning performance of the class, updating the learning material such as learning resources, the contents of the quizzes and questionnaires were required.

4. Discussions

Rapid development of the capabilities of mobile phones will overtake the capabilities of laptop or desktops. Instead, by 2015 mobile phones will overtake desktop computers as our primary means of accessing the internet [14]. With the mobile phone's concepts such as high personality, portability, ubiquity, as a wireless technology and as a pervasive technology will be led to leveraging the mobile phone for learning purpose. Successful implementation of mobile learning depends on well-defined requirements, the mobile learning environment requires consideration and definition of human elements (users), technological elements, content and pedagogy [15].

Currently, the research on mobile learning and software applications in Indonesia have become increasing, nevertheless the utilization of mobile technology in this case mobile phone into teaching and learning in the classroom is still low. This research is a pilot project for the implementation of mobile learning into teaching and learning in the Faculty of Education, State University of Malang, Indonesia. There were 29 undergraduate students of the Educational Technology Department, State University of Malang who were taking the course of Information Communication Technology for Learning (course's code: TPP408) had been engaged in the research.



Figure 4. Students' Activity: Utilizing QR code to access online web

All students in Educational Technology Departments have a mobile phone and most of their mobile phone supports QR code reader. However, only few of them had ever used it and know what its functions are. In this research, the QR code was used to help the students in accessing the online web easily. The QR code encapsulates the URL information into a digital block of black and white square. The lecturer prepared for the course with the encapsulation of long URL of the documents into QR codes. The QR codes were printed in a paper, then distributed to the students. They were allowed to use their mobile phone during the course to retrieve additional learning resources. The utilization of QR code for supporting mobile learning can be shown in Figure 4.

In order to investigate the students' perception towards mobile learning, they were asked to answer the questionnaire via mobile. The result of the questionnaire is all students giving a positive responds concerning the mobile learning and the utilization of QR code. Here are brief conclusion of the students' answer: Due to the access fee was charged to the students, 70% students agree with the integration of the mobile phone into teaching and learning and the remains don't agree. However, all students said it is very interesting learning style. Instead, 70% of students want to change their mobile phone into the smarter one for supporting their mobile learning. Concerning the utilization of the QR code, 65% of students know about QR codes and the others said "I don't know". All the students said that QR code application helped them to access the online web easily. These positive feedbacks from the students would be very beneficial for developing a robust mobile learning that can be more effective and suitable for students' conditions.

Integrating mobile phone into teaching and learning in the classroom is a first step to familiarize the students with mobile learning activity. This research project offers several benefits for a teacher in this case the lecturer and students, namely:

- (1) Paperless, we don't use any papers to collect the students' quiz and data from the questionnaire.
- (2) Marking the students' quiz or questionnaire are easy to do.
- (3) Online storage for students' quiz and questionnaire.
- (4) Online attendance for students.

The pedagogical perspective of the mobile learning style of this research project is Context Awareness Learning. Context awareness means gathering information from the environment to provide a measure of what is currently going on around the user and the device. Content and activities that are particularly relevant to that environment can then be made available context awareness learning [16].

5. Conclusions

The primary function of a mobile phone is as a voice communication tool, however the rapid growth of the mobile technology have changed the function not merely as a communication tool, but mobile technologies are becoming more embedded, ubiquitous and networked, with enhanced capabilities for entertainments, social interactions and internet connections. It is the opportunity to utilize a mobile phone as learning media tool.

In this research, the mobile phone is used to retrieve additional online resources, formative assessment or quiz and a questionnaire. The quiz and questionnaire were created by using Google Docs. The Google Docs offers the simplicity and a lot of advantages in representing the data. The form in Google Docs has a long URL and unable to memorize nor to write them. In order to overcome this problem, QR code was implemented. The QR code encapsulates the URL into a digital black and white square by using an online QR code generator (Kaywa Generator). The QR codes were printed in a paper, then distributed to the students. The student's mobile phone should have QR code reader to decode it. After decoding it, then the mobile phone's browser will directly link to the URL and open it.

The students that had been engaged in the research gave a positive responds concerning the integration of the mobile phone into teaching and learning and the utilization of QR code for supporting mobile learning. This learning style had given a lot of advantages for the teacher and students, namely: paperless, marking the students' quiz and questionnaire easily, online storage for quiz and questionnaire and also can be used as online attendance. From the viewpoint of pedagogical perspective, it is a Context Awareness Learning. Context awareness means gathering information from the environment to provide a measure of what is currently going on around the user and the device.

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