

EMBEDDING QR CODES IN THE TEACHING AND LEARNING PROCESS

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Abstract

The purpose of this action research is to explore the potentials of the Quick Response (QR) codes in mobile devices. In this research, QR codes and the smartphones are used as teaching tools in the classroom. Quick Response codes are two dimensional barcodes that are used to encode and decode information. These codes can contain information such as text, URL links, automatic SMS messages, or any other information that can be embedded in a two-dimensional barcode. This encoded data can be decoded by scanning the barcode with a mobile device that is equipped with a camera and QR reader software. The study setting was in an open distance learning institution and almost 95 % of the students in the classroom are working adults. Data were collected through observations and reflections from tutor and students. Almost 99% of the students have a smartphone which improves the reliability of implementing the research. Only one tutor volunteered to conduct the research using the QR codes. The tutor planned and prepared the appropriate content to be generated into the two dimensional barcodes. Students used their mobile phones to scan and decode the information embedded in the QR codes and class discussion continued from here on. Observations and reflections from tutor and the students are positive, suggesting that QR codes have the potential to be used in the teaching and learning process.

Keywords: QR codes, mobile devices, action research, lifelong learning

Introduction

Quick Response (QR) codes are 2-dimensional barcodes introduced in 1994. A piece of long multilingual text, a linked URL, a business card or just any information can be embedded into the two dimensional barcode. It is readable with moderately equipped mobile devices, QR codes can connect the users to the information quickly and easily. The following is an example of the 2-dimensional QR barcode



Figure 1: An example of a Quick Response (QR) barcode

What message is embedded in the QR code shown in Figure 1?

If the mobile phone has the capability to download a barcode scanner, once the code is scanned, the message will read as:

“EMBEDDING QR CODES IN EDUCATIONAL INSTRUCTION: AN INNOVATION”

The QR barcodes have gained recognition as an effective tool in marketing, advertising product information and logistics (MGH, 2011). It has also gained interest in the education sector as mobile devices are equipped with cameras and downloadable software. The barcodes are most commonly used for directions to locations and business cards and access to course information and study materials (Walsh, 2010; Hicks and Sinkinson, 2011). However, in the higher education sector, as students take ownership of their own learning, it becomes the task of the institution to provide a fast, flexible, convenient and user-friendly way for students to access content and learning materials online (Bobeva and Hopkins, 2012).

In this paper, the researchers explore the potentials of QR codes as an aid in the teaching and learning process. This is the first cycle of a pilot study, thus researchers are mainly focusing on the user's mobile experience with the QR codes presented to them in the classroom during their tutorial sessions.

Literature Review

Research has shown that learners are increasingly searching for learning materials which will allow them greater flexibility and convenience to suit their active lifestyle (Traxler, 2007). Several studies on the possibilities of integrating m-learning in the classroom received similar positive reaction from students (Clarke et.al 2008, Al-Fahad, 2009; Wang, 2009; Garrett & Jackson, 2006; Cavus & Uzunboylu, 2009; Uzunboylu et.al, 2009; Manair, 2007; Maag, 2007). Students agreed that using mobile devices was convenient and enabled learning to be flexible and portable (Clarke et.al, 2008; Cavus & Ibrahim, 2009; Bottentuit Junior, 2008; Al-Fahad, 2009). Accessing stored information in the mobile phones can be rather time consuming and frustrating. Therefore to increase the impact of the capability of the mobile phones, some institutions are using the QR codes to provide learners with speedy and ready access to information and services (Ramsden, 2009).

What is a QR code? QR codes are 2-dimensional barcodes that is capable of holding 7,089 numeric characters, 4296 alphanumeric characters, 2953 binary bytes, 1817 Kanji characters or a mixture of them (Law and So, 2010). QR codes can store information in both vertical and horizontal directions. It can be read from any direction in 360° through position detection located at the three corners as shown in Figure 1.

This high capability to store information confidentially has gained importance in the educational context through the mobile learning platform Pachler, 2010; Sharples, 2007). The significant characteristics of the mobile learning such as location independence, time independence and meaningful content are undeniable reasons why mobile devices should be used as part of the teaching and learning process. Location independence refers to learning not only restricted to a fixed location, time independence means that learning may extend beyond the normal classroom time and meaningful content refers to wide coverage of content including pictures and videos. The capabilities of the mobile learning platform will further be enhanced in the educational context with the inclusion of QR codes carrying the course content.

Development of the Conceptual Framework

Figure 2 shows the researchers' conceptual framework as a tool to benchmark the process of conducting the research. The framework is adapted from Clayton, Elliot and Twohey (2009). Engaging learners and empowering tutors to use the potential capabilities of QR codes in the mobile learning environment are two important aspects to be answered in this study. Training the tutors to develop learning content using QR codes and also ensuring students to be engaged with their new style of learning are the predicted challenges the researchers will have to face with.

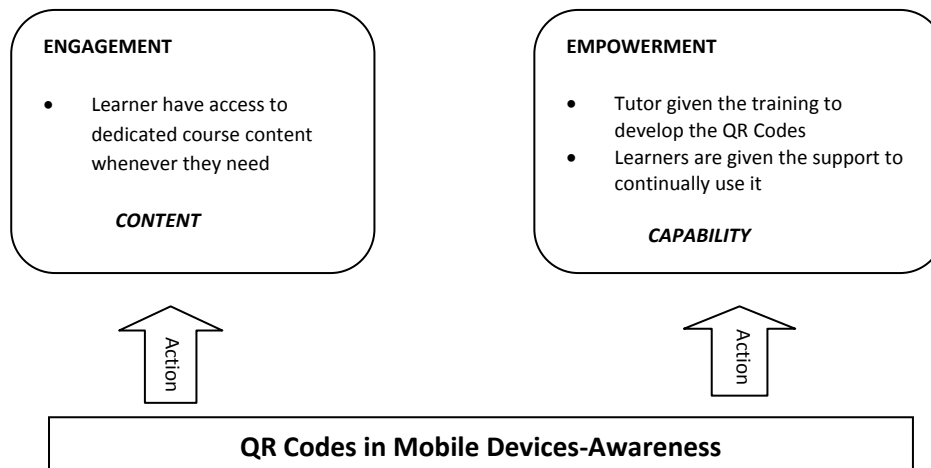


Figure 2: Conceptual framework for the QR codes in mobile devices-awareness

Study Setting

Studying in an open distance learning institution like OUM is different from studying in the conventional universities. In the traditional mode, students are fresh from school and attend lectures as full time students. They have frequent face to face contact with lecturers, for example, during lectures and they have separate tutorial sessions. Students have a good time span for studying in the 14 week conventional type of university compared to the working adult who has an eight hour face to face tutorials in the open distance learning setting. Nevertheless students are ensured the best in learning. Whatever learning differences or gaps to assimilate, accommodate or construct knowledge, has been taken care by the university by providing a range of learning tools for students.

In the open distance learning mode, students are required to be self-directed and independent learners. At OUM, students are motivated to regulate 80% of their study time on their own. They would have to manage their inner sense of motivation to plan and regulate their studies and at the same time making sure all other commitments are settled as well. To regulate one's own learning is one of the characteristics of a lifelong learner.

The remaining 20% of student's learning time is made up of face to face tutorials and the online interaction with e-tutors. Actual contact time in the face to face tutorials is just a mere eight hours sessions where they meet for four times in a particular semester. Tutorials are conducted once a fortnight, and being working adults, students are allowed the flexibility to decide whether to attend the face-to-face tutorials or to go online and interact in the online discussion.. However, a majority of OUM students are willing to sacrifice their weekends to attend tutorial sessions to discuss content and also perhaps assignment questions. In the face to face tutorials, students are guided and led by tutors from diverse academic background and experiences. Some of the tutors are working in the industry with a number of teaching experiences, and some are from the various public and private higher education institutions. From this wide spectrum of tutors, there will be differences in the delivery method in the classroom.

OUM provides a learning management system called the *myVirtual Learning Environment*, (myVLE) for students to get immediate access to related administrative matters. Besides, myVLE is also another learning platform for students where students interact with their fellow classmates in the same learning centre and also from the other learning centres in the country. Yet again in this environment students are encouraged to participate actively with peers and the e-tutor for further discussion on assignment and subject matter content. The e-tutors have the responsibility to entice students into the myVLE platform but here again students are given the option of either to be active or otherwise in the online forum.

OUM strives to give the best to all students; to ensure that students are being given the best in services especially from the administrative processes, facilities and of course, top of the list is to give the best and most effective method for student to learn.

At OUM the main goal in the teaching and learning process is to establish a learner-centered approach where students are actively involved and made to become willing learners and be interested and enthusiastic in their learning environment. Students are trained to develop skills of a lifelong learner, being able to search information and assimilate new information to the knowledge that they have. While students are equipped with a variety of learning tools, as a lifelong learner, they have to be able to evaluate the appropriate tools to improve their learning skills. Students gain access to learning materials in the form of i-lectures, i-tutorials, e-learning platforms such as e-GATE, Maths Resource Center (MRC) and html-based modules to improve their understanding on a particular concept or topic. These technological based learning materials are located at myVLE for easy access to all students.

While most of OUM learning tools are basically developed in the e-learning platform, we can increase flexibility to learning by embracing the m-learning environment provided that the appropriate educational input is stored and this can be implemented by using the QR codes technology. Current survey on the use of smart phones showed that almost 95% of OUM students own a smartphone and taking advantage of this, the researcher intends to enhance learning using QR codes stored in mobile devices. The QR codes in the m-learning environment will be another supplemental teaching tool to be used by tutors to connect to students and to establish a learner-centered teaching approach where students will feel motivated and updated with latest technology while studying at OUM.

Objectives of the Study

Only teachers can improve teaching, and unless they experiment on something new, teachers will not change, let alone improve. Based on the above statement the objective of this research are as follows:

- (i) To examine the impact of QR codes on students' learning based on students' attitude, interest, motivation and engagement.
- (ii) To create awareness among tutors on the potentials of QR codes as a teaching aid in the teaching and learning process.

Research Questions

This research aims to answer the following research questions:

- (i) To what extent does QR codes enhance students' attitude, interest and engagement?
- (ii) What are the reactions obtained from tutors on the potentials of QR codes as a tool to enhance the teaching and learning process?

Research Methodology

In addressing the purpose of this research, the researchers will employ the action research methodology.

“Action research...aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing this twin goal requires the active collaboration of researcher and client, and thus it stresses the importance of co-learning as a primary aspect of the research process”. (Gilmore, Krantz & Ramirez, 1986)

Quite simply, the term action in action research is for the researcher to bring about change in some activity or for this particular research is the teaching and learning process. On the other hand, research is to improve understanding of the researcher or the student, or both involved in the research. Those who apply this approach are practitioners who wish to improve understanding of their practice, usually academics who are looking for improved practice in the day to day delivery of instruction in the classroom.

In action research, the researcher studies the problem systematically and ensures the intervention is informed by theoretical considerations. Much of the researcher's time is spent on refining the methodological tools to suit the exigencies of the situation, and on collecting, analyzing, and presenting data on an ongoing, cyclical basis (O'Brien 1998). Its focus is turning the people involved into researchers, because people learn best, and more willingly apply what they have learned, when they do it themselves. It also has a social dimension - the research takes place in real-world situations, and aims to solve real problems.

The aim of this study is to examine the impact of QR codes on students' attitude, interest and engagement in two selected courses. Due to certain unforeseen reasons only one course managed to be conducted in the tutorial sessions using QR codes. This is the Management Accounting course. The tutor for this particular course have been briefed by the researcher and trained on how to develop the QR codes. The main method to obtain data will be through tutor's reflection of the teaching and learning process in the classroom during the tutorial sessions and also reflections given by the students after each tutorial. The tutor will collect the reflections given by the students and through his own reflection, will improve on the teaching and learning process for the next tutorial session. This will be done continuously for the four tutorials.

Development of QR Codes

How is a QR Code Generated?

QR code is a two-dimensional barcode that is machine-readable. It is an optical label that contains information about the item to which it is attached. A QR code uses four standardized encoding modes (i.e numeric, alphanumeric) to efficiently store data and extensions may also be used. A QR code consists of black modules (square dots) arranged in a square grid on a white background, which can be read by an imaging device (such as a camera).

There are a few steps to generate a QR Code:

STEP 1: Prepare the information to be presented. The information to be embedded in the code could be in the form of a plain text (alphanumeric) or an URL link (i.e. <http://www.abc123.com>).

STEP 2: There are various free QR code generator websites available online, such as:

- (i) www.the-qrcode-generator.com
- (ii) qrcode.kaywa.com
- (iii) www.qrstuff.com

For this study we are using www.the-qrcode-generator.com. It is free, simple and user-friendly.

STEP 3: Insert the intended information into the QR Code Generator. For example,

“Welcome to BBAP2103 Management Accounting”

As the information (alphanumeric) is being keyed in, the QR code is directly generated. A small change in the information may also change the “design” of the code.

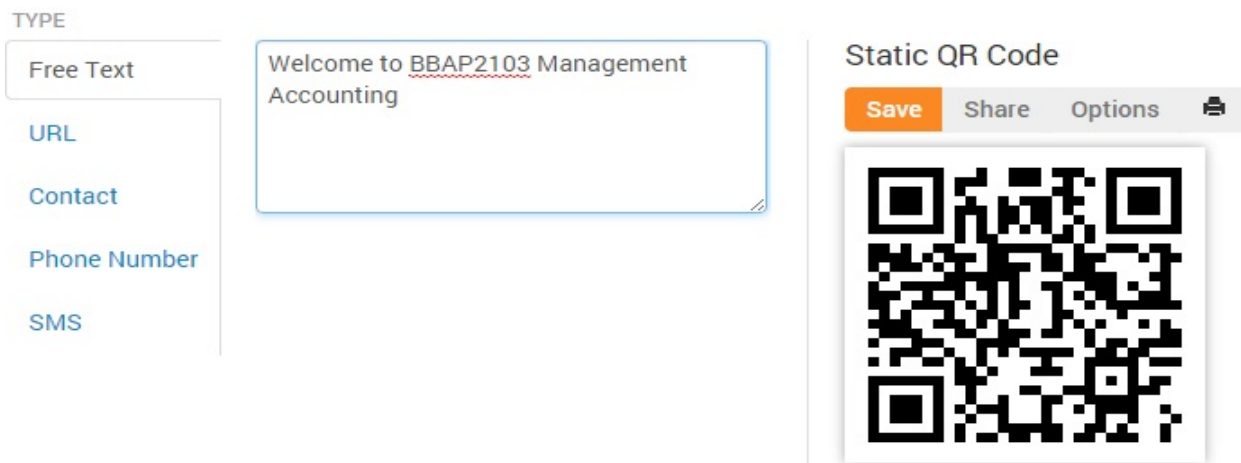


Figure 3: Illustration of the QR code generator

STEP 4: Save the code and label it (in .png format).

STEP 5: Attach the saved code (the .png format) into any presentation deliverables (i.e. power point presentation, spreadsheets, word documents etc).

Research Findings and Discussion

In this part, the discussion on the research findings following the action research undertaken will be presented in the form of chronological experience by the tutor involved in the data collection.

The reflections from the tutor are presented in chronological form.

Tutor's Reflections

The most time-consuming part was verifying that the material is accessible on different kinds of mobile devices. The QR activities worked better with mobile devices that have a larger display.

The following is the summary for the classes conducted using QR codes in the first round of the research:

In the first class, only 7 out of a total of 14 students attended. There are 2 active users, 2 tried installing but failed, 3 showed less interest or maybe they do not have smart phones. The response was quite satisfactory, students managed to capture the message and assimilate it with the usual learning.

In the second class, only 9 out of 34 students were present. Around 3-5 students tried and used QR code presented in the class. Students were not too keen to try but after downloading the barcode scanner they started to reap the basic benefits of it. I told them the purpose of having this exercise using QR code is to promote mobile learning, emphasizing that learning can also be accessed through their mobile phones. Figure 4 shows students trying to scan the QR code presented on the slides presentation.

I had a better experience in the second class where more than half of the students were highly keen to use it and they were quite interested to try not just one but more codes. The best part for them maybe they do not need to prepare the whole diagram once they know it is embedded in code.

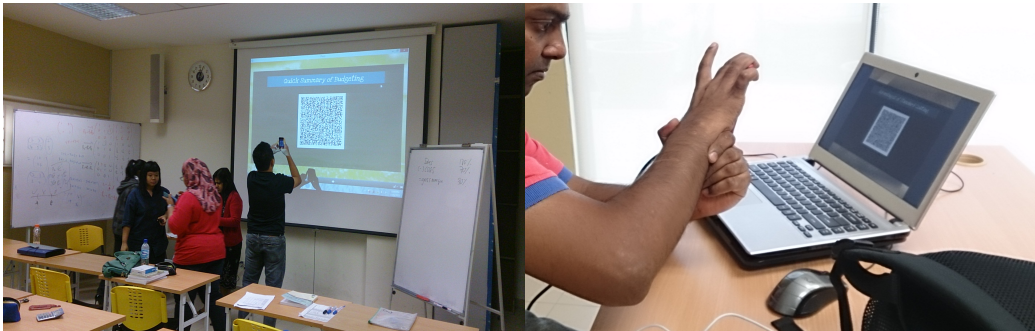


Figure 4 (a), (b): Students actively involved in the lesson

To encourage the non-users, I repeatedly advised them that whatever that is captured in the codes are the same with the ones presented in the normal modes of class delivery (i.e. whiteboard, slides, and module).

I am very happy to observe that the regular users kept using and capturing the codes during the last class (Figure 4a and b). Some even looked professional; they scan and go before the end of the class. I felt good and satisfied that I have shared a new technique of using the QR code for their own purposes. The only drawback that I have is that some students know very little about the advantages of the QR codes as a learning tool.

Despite the challenges to prepare the codes and some technical problems with the internet connection, the tutor noted that QR codes have its advantages in the educational context. The QR codes:

- Promotes a new learning environment, adding up more spices to the usual delivery mode;
- Taps on the existing in-class culture of students holding hand-phones, in a more appropriate manner;
- Shortens the time taken by the tutor to write up or learners to copy down notes;
- Presents some topics/notes/facts/theories/formulas in better forms such as graphs, diagrams, and
- Helps tutors to share learning materials in the smaller version in the form of codes and also makes teaching more efficient.

Students' Reflections

Some of the responses given by students in the evaluation form handed by the tutor are as follows.

“I enjoyed the lesson very much, I think I can understand the exercises better”. This is shown in Figure 4 and 5 where students are actively involved in the lesson.

They agreed that the QR codes are quite handy and easy to use. “I prefer to use the codes rather than writing down notes. It’s faster and easier since we can read it over and over again from our phones”.

“I have seen the barcodes at a number of places but I did not know that we can use it for learning.”

Another student responded;

“We can make our own short notes using the QR code generator”.

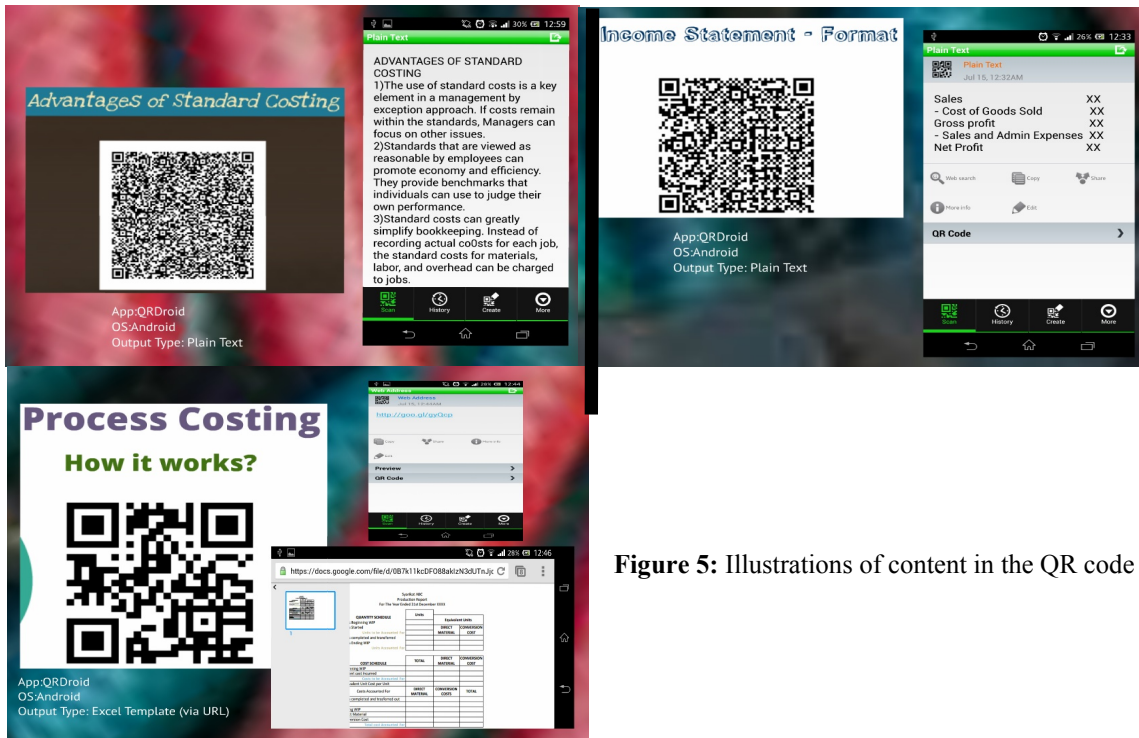


Figure 5: Illustrations of content in the QR code

Discussion

This study explored the potentials of the use of QR codes in the teaching and learning process. When the QR codes are generated, the mobile devices equipped with the barcode scanner are used in class to decode the information in the QR codes. From the development of content pertaining to the subject matter tested, this research indicated that with QR codes, it is possible to create personalized, situated and authentic learning as well as collaboration. These characteristics are the core characteristics of mobile learning. As a first phase research project, this study emphasizes on the delivery of content in the classroom. However, a number of studies has shown that QR codes can be use outside the classroom situation (Law and So 2010, Lee et al. 2010 and Osawa et al. 2007).

This study has its limitation since it is conducted within a limited time, a rigorous and longer term evaluation should be conducted to clarify that QR codes can enhance personalized, situated and authentic learning as well as collaboration. The other limitation of this study is that the learning effects were not sufficiently measured. Future experiments should consider measuring the impact of QR codes on learning.

Conclusion

The use of QR codes in education is still in its early stage. The planning and preparation of the correct material to be generated into the QR code is an arduous task for the tutor especially if we are not familiar with QR codes. It takes a lot of the tutor's time to ensure that everybody in class knows how to use it. Tutors have to take into account the pedagogical aspect of teaching in planning the QR codes rather than the technologies. The concentration should be on the learners rather than the technology used. If it is not well planned, the whole lesson will fail in motivating students.

Similar to Law and So's (2010) findings, we also found that the students were very enthusiastic and motivated to know the content embedded in the QR codes. Students were actively involved by working collaboratively with peers. We found that the general perception of the students of QR codes for the Management in Accounting course was positive. They found QR codes motivating especially when the QR activity was well-planned and organised and the technology was functioning well. Being curios to know what is embedded in the codes and wanting to know how the codes are generated shows that QR codes are meaningful to them. The students also stated that QR codes brought much-wanted variation to the classroom and they find it much easier

to understand certain concepts in the module. The sample test items developed by the tutor helped them to illuminate deeper understanding of difficult concepts.

When content are well-formulated and organized, QR codes in the mobile learning should be able to bring substantial benefits to the students as well as the university, especially by keeping the students connected, engaged and motivated. This will contribute to the enhancement of learning experience of the students and if used effectively it can be a means for encouraging lifelong learning. We also found that QR codes can support both independent and collaborative learning and that QR codes can motivate and engage learners.

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