

Utilizing the quick response (QR) code within a Japanese EFL environment

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Within Japan almost all mobile camera phones are equipped with two-dimensional barcode scanning technology as a standard feature. Consequently, QR (Quick Response) codes are now widespread throughout Japan as a means of product identification and advertising. Despite this, their implementation into public and private educational settings has been relatively slow due to the traditional exclusion of the mobile phone from the language learning classroom. This paper describes an investigatory project which attempts to introduce three specific examples of basic QR code-driven activities into a Japanese university English as a Foreign Language (EFL) classroom. The paper proposes that the merger of the mobile phone and the QR code be considered a productive way forward in achieving a semi-ubiquitous computing environment. The attitudes of 132 students toward mobile phone and QR code usage are discussed along with the advantages and disadvantages surrounding the implementation of such projects.

The mobile phone

One of the most readily accessible technologies in the move away from a reliance on the personal computer is the mobile phone. In addition to their versatility, and compared to other handheld devices, mobile phones are relatively cheap and have become something of a social norm. This normalization can be seen within Japan where almost all university students own a mobile phone. In a study of 976 Japanese university freshmen, 98% of girls and 94% of boys reported owning a mobile phone (Dias, 2002). Other research suggests that this figure has since increased and is now believed to be very close

to, if not already, 100% (Thornton & Houser, 2005; Susono & Shimomura, 2006). Such an increase to almost blanket usage among Japanese university students is symbolic of the perceived need for people to be interconnected and accessible regardless of time and location. As Weiser (1991, p. 933) argues: 'the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.' The mobile phone has achieved this goal on a societal level with two-thirds of the Japanese population being regular mobile phone users (Dias, 2002) and an estimated 1.7 billion mobile phones in use on the planet (Keegan, 2004).

Thornton and Houser (2005), in a survey of 333 Japanese university students, found that 99% of the students sent as many as 200 email messages per week, 66% emailed friends to talk about class-related issues and 44% emailed specifically for the purpose of study. In an earlier study Thornton and Houser (2001) emailed English vocabulary lessons to the mobile phones of 44 Japanese university students and found that 71% of these students preferred the lesson on the mobile phone as opposed to the personal computer. In their study, 93% of the students reported that the combination of the mobile phone and the vocabulary lessons was a valuable teaching method. Elsewhere in Asia mobile phones are playing a much wider role within educational contexts. At Sookmyung University in South Korea, students can use their mobile phone to confirm class attendance, enter libraries, buy food and prove their identity.

Quick response codes

The Japanese company Denso-Wave originally invented the QR code in 1994 as a means of tracking vehicle parts during the process of manufacturing. Under optimal conditions these two-dimensional barcodes can hold up to 7,089 characters of numeric data, 4,296 characters of alphanumeric data, 2,953 bytes of binary data, and 1,817 Kanji or Kana (<http://www.denso-wave.com/qrcode/aboutqr-e.html>). Furthermore, they are very resistant to damage with high-levels of error correction possible, meaning that they can still function correctly when disfigured or marked.

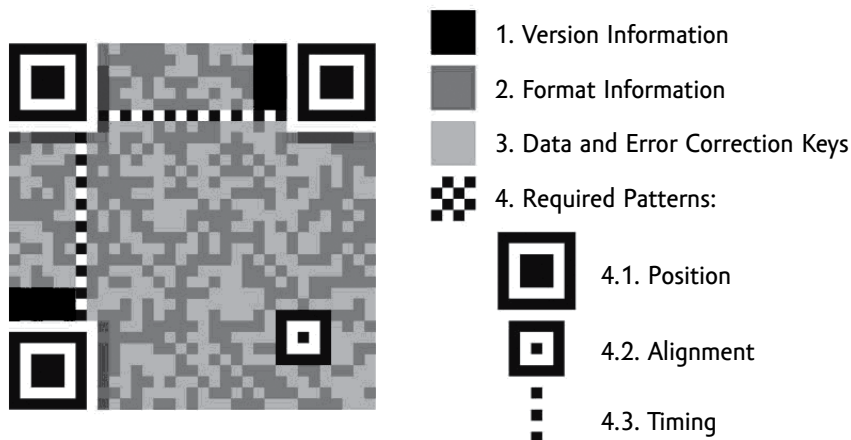


Figure 1. The structural make-up of a typical QR code

A unique feature of these codes is that their size is relatively flexible and not entirely dependent on the amount of data stored within the code. The two **QR** codes shown below include exactly the same amount of data. They both include the message: 'It's back on **DVD** Sept 10th.' The **QR** code on the left is a poster in central London measuring over 3m × 3m whereas the figure on the right is a mere 4cm × 4cm. A notable feature of the London poster is that the **URL** promoting the product has been omitted from the **QR** code. This illustrates that the **QR** code in the **UK** as well as within the wider European region holds a novelty factor due to the relative newness of such a sight combined with the inability of many mobile phones to scan such a barcode without fee-based additional software.



Figure 2. The variety of sizing in the design of two **QR** codes containing the same data

In addition to the flexibility of sizing, **QR** codes are also very easy to create. There are numerous free web-based generators offering the user a range of simple options (<http://www.viooli.com> or <http://qrcode.kaywa.com>). This simplicity makes them extremely appealing to those teachers and students who possess little or no technological knowledge. Perhaps, most attractive, though, is the fact that these **QR** codes are readable with standard software preinstalled on almost every Japanese mobile phone which has picture-taking capabilities. This has been a major factor in the rapid advancement of such technology within Japan compared to other parts of the world.

In keeping with the original function of the **QR** code they are still widely used to give an object an identity, which allows a person to interact with it through the use of a mobile phone. In addition to giving objects identities the **QR** code can be used as a means of transferring information directly to a mobile phone without the reliance on manual input methods such as email and texting. This is particularly useful when transmitting long **URL** information or entering contact information into an address book. Currently, within Japan the **QR** code can be found throughout the social landscape: on advertising billboards, product information labels, business cards, website **URLs** and even vending machines.



Figure 3. The QR code is used throughout Japan for a variety of functions

The current popularity of the QR code within Japan and the envy of the struggling Semacode¹ and Shotcode² make now an ideal time to utilize its potential within an educational environment.

One of the earliest implementations of the QR code within an educational environment within Japan was at an elementary school in Tokyo during 2004. The children at the school were taught how to scan QR codes placed on classroom objects by using a mobile phone. In addition, the children were required to record a verbal message imagining what the object would say if it could speak (Takeyama, 2004). Within the university setting the QR code has been employed predominantly in an administrative capacity rather than as a part of the classroom pedagogy. Fujimura and Doi (2006) present a project in which students give feedback during and after a lecture on their degree of comprehension. The students have the option of scanning a QR code of a long URL which takes them to a mobile phone database where live feedback on the class during an interval can be given. This feedback is stored in a database which is immediately viewable from the teacher's computer at the front of the classroom. The lesson content can then be adjusted based on the intervention of the students. In a similar study Sususo and Shimomura (2006) combine mobile phones and QR codes to gather formative class assessments. The students are presented with four different QR codes each offering a degree of agreement to a set question. The student is then able to scan the code which best represents their feelings at any point during a lecture with the data again being sent to a database viewable by the lecturer on his/her computer.

Based on the lack of prior research combing the mobile phone specifically with the QR code as a part of the classroom pedagogy, the current project will implement three practical QR code activities into six Japanese university EFL classrooms in order to survey students regarding their attitudes toward such mobile phone and QR code usage. In addition to being consistent with the students' regular task-based curriculum, the activities selected will promote active learning and self-discovery, something which is required if the enhancement of the student learning experience is of interest (Leigh & Spindler, 2004). The author has

been experimenting with the use of QR codes at the current institution for approximately 10 months. This experimentation has been primarily in the form of QR code homework datasheets in which all students are given a datasheet as illustrated in Figure 4. Each datasheet contains a number of QR codes which relate to the pictures shown. Within each QR code there is a question asking the student to react to the picture shown in a number of ways (*interpretation, opinion, reflection*). This reaction is then used as the basis of subsequent classroom discussion and spin-off student-based activities. These early activities were based on the ideas proposed by Prosser and Trigwell (1999) who argue that engaging students and making them actively participate rather than being passive listeners has been shown to increase learning outcomes. The text shown within the figures below is that which is contained within each of the QR codes.

		Japan has many cool bars and restaurants. In the picture you can sit on a bed and have a drink and some food. Have you ever been to an unusual bar or restaurant ? What was it like ? What made it unusual ?
		Many foreign visitors to Japan enjoy wearing Japanese Kimono or Yukata. Have you ever worn the traditional clothes of another country ? How did you feel ? What did you wear ? If you have never worn such clothes how do you feel about the picture on the left ?
		The weather in Japan can get very cold in winter with lots of snow. What is the coldest you have ever been ? Where was it ? How did feel ? Do you prefer to be too hot or too cold ?

Figure 4. An early example of a QR code homework datasheet created by the author

Although no formative assessments have been made, students responded well to these homework activities prompting the author to consider further widespread implementation and attitudinal assessment.

Participants and context

The participants for this project were 132 students at an innovative private Japanese university. The students were a mix of both freshmen and sophomores taken from six random classes during the autumn semester of 2008. The university where these students study is learner centered and strongly promotes learner autonomy and self-access learning both within the classroom and through a state of the art Self-Access Learning Centre which provides the students with a rich learning environment. For all of the students within this study, approximately 50% of their lessons are conducted in Blended Learning Spaces (BLS) in which each student has their own individual notebook computer and access to other wireless technologies. As a preliminary question prior to the undertaking of this project,

all students were asked whether they owned a mobile phone as this was a condition of participation in the current research project.

Table 1: Demographics for the current study including mobile phone ownership

Class	Subject	N	QR Code Activity Undertaken	Age	MP Ownership
1 + 2	Writing	46	Paired Opinion Paragraphing	18+19	100%
3 + 4	International Com.	45	Collaborative Mobile Tagging	18+19	100%
4 + 5	International Com.	41	Problem Solving Treasure Hunt	19+20	100%

Procedure

Paired opinion paragraphing

The first QR code activity to be implemented was done so within two freshmen writing classes and sought to give the students further opportunities to create opinion paragraphs based on their interactions with other people and materials. These classes had been studying paragraph structure and had performed numerous exercises on opinion paragraph writing. Firstly, the students were grouped into pairs and selected a random QR code card like those shown below in Figure 5. These small cards instructed the students to scan the QR code and perform the task which was subsequently displayed on their mobile phone. The tasks given fell into two distinct categories: either speaking-based or reading-based. The speaking-based tasks focused on themed interactions with specific people in order to ascertain their beliefs or opinions about a set subject. After interacting with the person(s) the students were required to return to the classroom and write an opinion paragraph based on their personal feelings about what the target person(s) had said to them. The reading-based tasks gave students instructions to find a specific book, magazine or newspaper within the university’s Self Access Learning Centre. The instructions included a specific reference to either a page number or a paragraph number. The students were then required to read the set paragraph, article or title and return to class in order to write about their own viewpoint in relation to the material read.

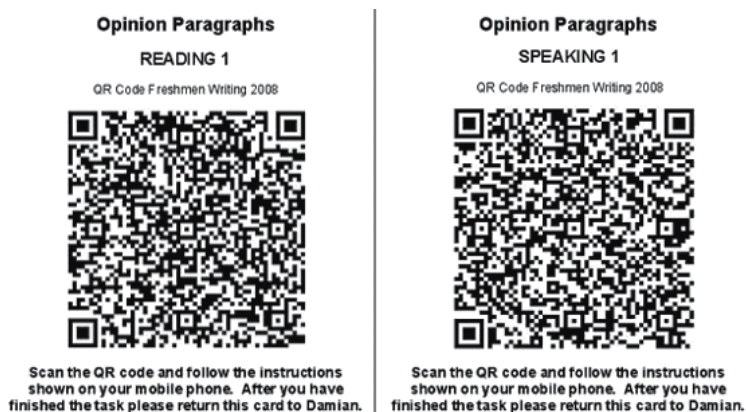


Figure 5. A typical example of a speaking- and reading-based QR code card

The above QR code cards feature the following instructions, which appeared on the students' mobile phones:

Speaking 1: With your partner go to the **ELI** Lounge area and start a conversation with someone (teacher or student) about world peace. Ask the person how they think world peace can be achieved. Write about your own feelings in relation to what the person who you spoke to said.

Reading 1: Please go to the Self-Access Learning Centre and find the book entitled *Understanding the News in English 3*. Look at the story on page 34 and write an opinion paragraph either agreeing with or disagreeing with the main theme of the story. Book Code – **ME/N/10027 (SALC)**

Collaborative mobile tagging

The second QR code activity implemented used 'collaborative mobile tagging' with two freshmen international communication classes. This activity aimed to promote collaborative team work and to provide students with an opportunity for authentic, socially framed communicative interaction outside of the traditional classroom environment. Firstly, the students were grouped into small groups of four or five students. Each group member was then assigned a number within the group (**S1, S2, S3, S4, S5**). Within each group **S1** was given a QR code which they were instructed to scan with their mobile phone. After scanning this QR code the task instructions appeared on their mobile phone. No other group member was allowed to view this message and **S1** had the responsibility of conveying the information to the other members in the group. Below is an example of one of the first messages given to **S1**:

Go to office 6-207 and find out what the teacher's favourite food is. If there is nobody in this office try a different office. Remember to ask permission to enter the office and ask if the teacher can spare a few minutes to talk to you. When you have an answer write it down and go to the **URL** link below to let student number 2 scan the QR code. (Please see: <http://www.eapstudy.com/2.gif>)

All students were then required to proceed together to complete the set task although the primary responsibility for communication was with **S1**. After **S1** had obtained the desired information and connected to the link shown a second QR code appeared on the mobile phone screen of **S1**. **S2** was then required to scan the QR code from the mobile phone of **S1** using his/her mobile phone. This represents the act of collaborative mobile tagging between two people in order to exchange information and is shown below in figure 6.

S2 then received their message and a **URL** link similar to the one shown above. **S2** then repeated the process performing their set task along with the other group members. This process was repeated until all students had completed an individually assigned task. The tasks were spread around the university campus so that students could experience different surroundings and interactions with different people. Figure 7 shows the basic process of the collaborative mobile tagging among a group of four students.



Figure 6. The act of collaborative mobile tagging between two students

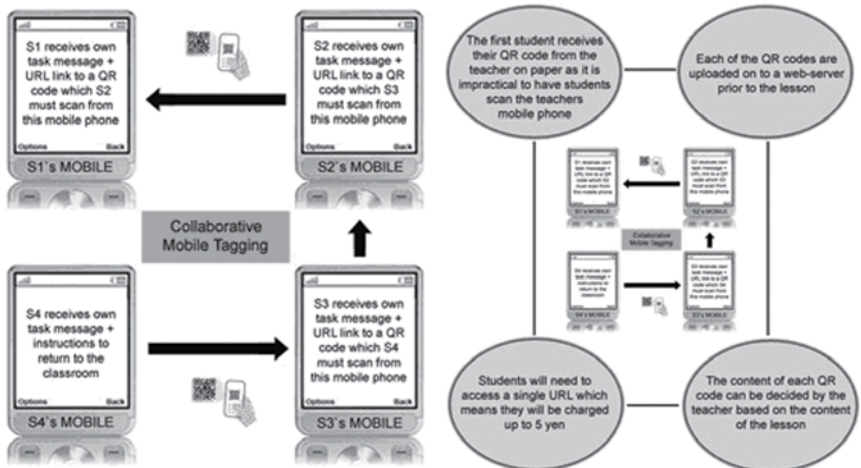


Figure 7. The task process of collaborative mobile tagging among a group of four students

Problem-solving treasure hunt

The final activity implemented was a problem-solving treasure hunt with two sophomore classes studying international communication. The aim of this activity was to have the students working as a team in order to solve a number of problems presented to them in the form of QR code clues and hints concerning different locations around the university

campus. Students were firstly grouped into groups of five or six. Each group was given a QR code (QR1) which they were instructed to scan with their mobile phone. The responsibility for scanning this first QR code was decided within each group and the teacher did not specify a certain person to scan the code.

As a group, students were required to try and ascertain the location which this first message was directing them to. When the students thought that they knew the location they could go there as a group to try and find QR2. If the students had correctly solved the problem they would find QR2 hanging up on the balcony of a popular student restaurant. QR2 would then need to be scanned and the subsequent message solved in order to move on to the next location where QR3 was waiting. In addition to the basic problem solving nature of the tasks, at the end of each message was a keyword. The keyword was a single word which students were required to write down after solving each message on a handout given to them at the start of the activity. In all there were eight different QR code locations with seven different keywords. If the students located all eight QR codes which were hidden around the campus they would have seven keywords. These keywords could then be rearranged to create a message. The first group to report back to the classroom with the correct message was deemed to be the winner.



Figure 8. The scanning of the actual QR codes which the students were required to find

Data collection

After all classes had completed their respective QR code activities the students were given a seven item survey which attempted to ascertain their attitudes and opinions on the use of the mobile phone and QR code as part of their EFL learning experience. All questions on the survey featured a basic yes/no choice as well as an open-ended space where students were encouraged to elaborate on their answers. The survey was compiled after a review of the previous research literature and in consideration of the current research project aims. All responses were then collected and the process of data analysis began. The decision was

taken not to focus specifically on the nature of each QR code task but rather to view the responses as a representative whole. This was due to the fact that the current project sought to assess the viability of the widespread implementation of QR code activities in general rather than the implementation of a single specific QR code activity.

Results

The survey data gathered from the 132 students is presented below along with the original questions used in the survey.

Table 2: The results from the survey given to the 132 students

Survey Questions (N=132)	Yes	No
Q1 Do you take your mobile phone to every class?	98%	2%
Q2 Do you ever use your mobile phone to study English?	44%	56%
Q3 Do you think using a mobile phone is a good way to study English?	68%	32%
Q4 Have you ever scanned a QR code to get some information?	83%	17%
Q5 Did you enjoy using the QR codes in the lesson?	92%	8%
Q6 Do you think QR codes can be used to help language learning?	59%	41%
Q7 Would you like to use QR code activities as part of the curriculum?	52%	48%

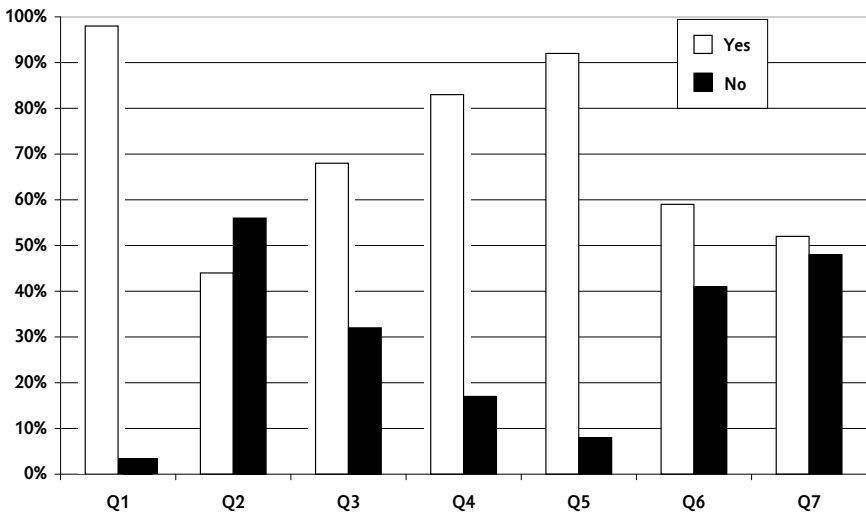


Figure 9. The results from the survey given to the 132 students

24 Through further analysis of the data it was possible to create a ‘typical student’ response based solely on the frequency of each yes/no answer given in the survey.

Table 3: The dominant characteristics of the students in the current study

% of Responses	Dominant Characteristics
98%	I always take my mobile phone to class with me
92%	I enjoyed using my mobile phone and QR code in the lesson
83%	I have scanned a QR code before to obtain some information
68%	I think that using a mobile phone is a good way to study English
59%	I think QR codes can be used to help language learning
56%	I never use my mobile phone to study English
52%	I would like to use QR code activities as a part of the curriculum

In addition to the responses shown above a significant amount of open-ended data was gathered. This was subject to a keyword analysis and the selection of student comments which shall be presented within the discussion.

Discussion

The results presented show that among the current sample of 132 Japanese university students, mobile phone ownership stood at 100%. This blanket response was also applied to the specific mobile phones which have the capacity to take pictures and scan QR codes. This adds support to the research findings of Thornton and Houser (2005) and Susono and Shimomura (2006) and further highlights that the popularity of the mobile phone with picture-taking capabilities is very high. Out of the 132 students surveyed, 98% reported regularly bringing their mobile phones to their classes. This is despite the fact that within the current research environment the mobile phone was not being actively used for studying English in any of the participants' language lessons. Outside of the classroom, 44% of the sample reported that they used their mobile phones to study English. This primarily took the form of using the dictionary function (21%), emailing friends in English (10%), accessing EFL websites (9%), vocabulary study (4%), setting the mobile phone default language to English (2%) and a host of other unspecified purposes (21%). Although 44% represents a moderate number of students, 68% believed that the mobile phone was a good way through which to study English. Within this 68% over 25 students commented that the mobile phone was a good way to study English because it allows information to be accessed anytime and anywhere. This large number of specific responses indicates the growing demand for ubiquitous language learning solutions. Having the option of studying location-free is something which the students reported as being highly desirable. Other student comments included: 'I can use the mobile phone easily anywhere', 'almost all young people have a mobile phone', 'we can study using the mobile phone with fun. It's a good idea,' 'I think everyone knows how to use a mobile phone so it is good to use it for study.' These responses re-emphasize the position of the mobile phone as the only financially and technologically viable solution which enables students to learn anytime, anywhere. Other handheld devices such as the iPod (especially the iPod Touch) and the Nintendo DS may offer the student a more in-depth experience but the costs are significantly higher than the costs involved in using the mobile phone, as is the learning curve for an inexperienced user.

Among the 32% of students who did not think that using the mobile phone was a

good way to study English, the specific reason given varied greatly. As previously found by Bryan (2004) students highlighted the fact that the screen size and text size were often too small, which had an effect on the students' vision: 'the screen is too small to do anything worthwhile.' Other students compared the mobile phone to the PC in terms of information available: 'the mobile phone does not have many websites in English for study so I prefer the computer.' Although such comments are well-documented problems it appears that the students also felt as though the mobile phone was something which should be kept out of the classroom due to issues associated with privacy: 'we play with the mobile phone so we should study without it.' Through informal talks with the students who took part in this research this was an almost ever-present issue. The fact that the mobile phone had become a central part of their social life, containing private data, pictures, videos and contacts led many students to state that they did not wish to mix such things with their English language study – especially when working with other students who may have to look at their mobile phone's screen in order to complete a task.

Focusing on the students' prior QR code usage, 83% had previously scanned a QR code to obtain some kind of information. Most of the information was related to product or marketing campaigns with no students indicating that they had used a QR code within an educational environment or as a part of their language learning experience. This further illustrates that QR codes, despite penetrating Japanese society on many levels, have yet to be acknowledged or used within the classroom for the transfer of materials and task instructions. Across the sample of 132 students, 92% reported that they enjoyed the activity which they performed as a part of this project. 42 students attributed this enjoyment to the fact that the use of the QR codes was a new activity,³ 35 students attributed this to the fact that using the QR codes was interesting and fresh, 13 students attributed this to the fact that using the QR codes was exciting and 8 to the fact that using the QR codes felt like an adventure game. The 8% who claimed that they did not enjoy the project attributed this to the single fact that some of the mobile phones could not scan some of the QR codes. This suggests that although mobile phone ownership and QR code scanning capacity were found to be at 100% there are still technical issues with either the QR code generator used or the specific abilities of different brands of mobile phone.

Regarding student attitudes toward QR codes and language learning, 59% of the students thought that QR codes could be used to help language learning due to the fact that they are fun and easy to use. 41% disagreed with this because some mobile phones could not scan each QR code and the information gathered was limited in size. When asked if the students would like to use QR codes as a regular part of the curriculum, 52% were in favor whilst 48% were against the idea. This split indicates that there are still several issues yet to be resolved before students can appreciate and value the usefulness of QR codes within the classroom. Reasons given for supporting their implementation again centered on the fact that the activities were considered to be fun, unusual, interesting and that they gave the students an opportunity to move around the campus whilst learning: 'It is like a secret code, so we must try to break it', 'the lessons were very interesting', 'sometimes we need fun to be motivated.' Those students against the widespread implementation of QR code activities re-stated that not all mobile phones could scan the QR codes and the mobile phone battery must always be charged: 'my mobile phone's battery disappeared half way through the activity so I needed to share my partner's phone.' Other students again, touched upon the issue of privacy: 'we must separate private things and our classes.' Finally, a small number

of students held the opinion that all mobile phones should be turned off in the classroom as they cannot be used for learning a language.

Conclusion

This investigatory project set out to show how the merger of the mobile phone and the QR code is considered a productive way forward in achieving a semi-ubiquitous computing environment. Although this project has demonstrated three task-based instructional activities and a strong student interest in the use of the mobile phone and QR code activities within an EFL classroom a number of issues remain. It appears as though fun and enjoyment are almost guaranteed with such activities; they permit students to break out of the traditional classroom and to immerse themselves within other social contexts whilst the mobile phone and messages provided by the QR codes provide a psychological link back to the teacher with no financial cost to either the student or the school. However, these positives are often offset against a number of common concerns which were shared across all six classes within this project. Further research should seek to identify the technical issues associated with some mobile phones' inability to scan the QR codes generated by various web-based generators. A number of students were not able to scan the QR codes used in this project despite having the barcode scanning function on their mobile phone. Secondly, the teacher must ensure that the actual content use within the QR codes promotes communicative interaction. Due to the limited textual abilities of the QR code it is difficult to imagine the presentation of complex text-based language learning exercises. Just as the communicative curriculum aims to provide students with opportunities for authentic language exchanges, QR codes must strive to do the same, additionally, students should be made aware of the primary function of the QR code within the language classroom – that being to set a task and give instructions rather than provide a complete learning solution.

This project has also illustrated that students have differing views on the use of mobile phones in the classroom despite their social normalization within Japanese society. Traditional attitudes toward the mobile phone and learning need to be challenged further in order to promote behavioural and attitudinal evolution. The teacher is in an ideal position to promote the message that the mobile phone can be used as a 'communicative tool' for facilitating language learning by providing students with the kind of small scale project presented in this paper in order to reeducate students on the use of basic technologies in language learning. Based on the issues discussed in this paper, QR codes do have the potential to be adopted as a part of an EFL learning curriculum although for the students to accept them as a valid learning facilitator, their level of knowledge concerning the role of the mobile phone within educational environments must first be developed.

Notes

1. The Semacode is the Canadian equivalent of the QR code. It is reportedly much slower than the QR code and is catching on slowly through North America in part due to the fact that many mobile phone providers offer the scanning capability at an additional cost.
2. The Shotcode was developed at Cambridge University in the UK in 1999. It requires the Shotreader software and can only be scanned with selected mobile phones within Europe.
3. The reference to 'new activity' is considered to be referring to the use of the QR code.

The actual tasks which were presented to the students had been undertaken during the previous semester without the QR code as a task-conveying medium and without the mobile phone as a facilitator of the task.

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