Quick Response with QR Code in the Curriculum

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Abstract

QR code, abbreviated to Quick Response code, has become widespread in modern life. People encounter this barcode in commercial, cultural and educational areas. As the bridge between online and offline media, QR code’s features include being easy to generate, quick readability, and an abundant information load. Because of these features, QR code shows promise for the future in education. QR code is expected to refresh the curriculum and bring more convenience, mobility, and interaction to the learning environment, for both mobile learning and face-to-face instruction. This paper concentrates on how to integrate QR code in the curriculum. Initially, the paper will define and introduce the application of QR code. Then, based on the curriculum-related features of QR code, the paper will propose specific examples of integration in the curriculum. Finally, after the analysis of potentials and current challenges, its future use in education will be discussed.

Introduction

Definition of QR Code

QR code is an alternative terminology for a “Quick Response” or “2D” barcode which can be decoded by downloadable readers on mobile devices with camera-scanning capabilities (Masis, 2011). The reason for its quick response is that QR code builds a bridge between online and offline media. Abundant online materials can be embedded in the barcode, including Uniform Resource Locator (URL), text, image, audio, and video. QR code can be found on magazines, marketing brochures, flyers, bookmarks, product tags, packaging, restaurant menus, trucks or trailers, Websites, and even video information screens in shopping malls (Michael, 2010; Masis, 2011). Once detected and read by QR code readers, the barcode will navigate users from those offline media to limitless online resources.

In spite of its powerful functions, QR code only pictures several black modules arranged in a square pattern against a white background, which are all the components of a complete QR code. The matrix structure of the pattern makes it possible to decode the barcode at a high speed from any direction in $360^\circ$. Additionally, this structure enables QR code to handle a large volume of information in various formats, such as numeric and alphabetic characters, Kanji, Kana, Hiragana, symbols, binary, and control codes (Byrne, 2011; Denso Wave Incorporated, 2012). One QR code is expected to carry up to 7,089 numeric-only characters (Denso Wave Incorporated, 2012).

Application of QR Code

Barcode technology has been widely employed for specific purposes in the fields of commerce, logistics, merchant, and customer management (Baik, 2010). Actually, QR code was first invented in the area of automotive industry in Japan to track automobiles in the process of manufacturing. The usage of QR code has been broadly
extended through the years after camera-integrated mobile phones skyrocketed (Chaisatien & Akahori, 2006). Currently, it is rather common for people to see QR code outside of the automotive industry.

Initially, QR code is most frequently used in commercial settings. The barcode could directly link customers to content with detailed introduction on products as well as customer feedback so that customers can make better informed decisions on products before purchasing them. Recently, mobile commerce (M-commerce) has become more popular in modern society based on the expansion of mobile phone usage. As one of the most frequently used applications, users in M-commerce employ QR code for purchasing food or drinks from vending machines, ordering concert tickets, downloading online music, and even making reservations at restaurants (Davis, 2012). There is no doubt that QR code makes commercial activities more convenient.

In addition, QR code can be found in stadiums, concert halls, tourist attractions, and schools to guide audiences, tourists, staffs and students to their destinations. For example, during a musical performance, organizers are able to compress a map of the concert hall and other useful information into a barcode and attach some copies on corners of that hall. The useful information could be an image, audio, or video document. With several different formats of guidance, audiences can find the places they want to go more quickly and easily.

Nowadays, Augmented Reality (AR) supported context-aware mobile learning is popular because of its flexibility, convenience, cost-effective, and user-friendliness (Jones & Jo, 2004). QR code, as a flexible application of AR technologies, has started to garner the attention of educational researchers. Some libraries attach QR code on book covers so that readers can know more about the author and contents of a book. Additionally, researchers integrate QR code in mobile learning to construct a context-aware learning management system (Chaisatien & Akahori, 2006). QR code demonstrates a great potential for being integrated into the curriculum and is expected to bring a refreshing reform to both distant learning and face-to-face instructions.

Curriculum-related Features of QR Code

Bridge Between Online and Offline Media

QR code is defined as a paper-based hyperlink (Sprague, 2010). Distinguished from other Web 2.0 tools which are only used in the online context, QR code can be both printed on paper materials and attached to Websites. With a QR code reader on camera-integrated mobile phones, users will be navigated directly to limitless online resources after the reader decodes these barcodes. Due to the possibilities of bridging online and offline media, QR code could potentially increase students’ interest and motivation to engage in instructional activities. For instance, many music instructors have integrated QR code in their curriculums. If a piano instructor wanted to encourage students’ self-assessment of their own performance, he/she can embed the link of a YouTube video about standard performance in a QR code and attach the code on students’ musical notation. Then students are able to access the video to evaluate how they played 24/7 as long as they have a QR code reader on mobile phones.

Concerning the function of hyperlinks to other information sources, people may argue that there have already been several kinds of online tools, such as online bookmarks. Online bookmarks consist of a series of URLs to users’ favorite Websites they collected and saved together. When users are searching information online, online bookmarks avoid the trouble of searching and typing correct links to pages where they want to go. To a certain degree, online bookmarks have already provided people with a lot of convenience. However, comparing QR code with online bookmarks, people will easily find the advantage of bridging the gap between paper and web via QR code.

Online bookmark can help users browse their favorite Websites only on condition that they are accessible to an Internet connection. Nonetheless, QR code can be placed almost everywhere including paper materials and online documents. Taking the aforementioned example of books in the library, QR code can be attached to book covers and navigate users to its online introduction after the barcode is scanned by the digital camera and analyzed by the QR reader. Correspondingly, it is obvious that online bookmarks cannot work without a network access. Because of the connection QR code constructs between the online and offline media, users are able to participate and interact anywhere and anytime as long as they get a code reader on mobile devices or a computer that has a digital camera.

Easy to Generate

In spite of its multiple functions, QR code is easy to generate. There are numerous free QR code generators online, and users may select the proper one to satisfy their demands. If they need to compose a colorful and complicated barcode, a high-level QR code generator (such as QR Stuff and Delivr) would help them out. Most often, a basic level of QR code generator (such as Kaywa) is adequate to produce a satisfying barcode. Users only need to open the generator pages and input required contents in the blank area. Then a QR code will come out within
several seconds. Therefore, it is easy and convenient for users to generate a QR code and get access to the bridge between online and offline media.

**Quick Readability**

Quick readability means QR code can be easily decoded. QR code reader, a common application for mobile phones or iPod, etc., can decode the code quickly. Although its composition and matrix of arrangement are very complicated, the decoding process is really quick for users. According to Liu, Tan, and Chu (2010), the decoding process requires only around 23 microseconds by a QR code reader. Up to now, numerous specialized QR code readers for various models of mobile phones are available and users can select the appropriate code reader according to their own preference.

On the other hand, quick readability also means users can access the targeted content in a simpler process. The contents embedded in QR codes are no longer only texts and characters but also links to multimedia files, like pictures, audios, and videos. As is often the case, people have to start the computer and open specific programs if they intend to view those multimedia documents. However, all these procedures could be avoided upon the usage of QR code. Without logging into their accounts, QR code readers would directly demonstrate all the contents that users expect after decoding, no matter what the formats are. In other words, the decoding process would be finished once the reader captures the targeted code. Furthermore, QR code could navigate users exactly to where they expect to go, escaping the trouble of inputting a wrong link (Law & So, 2010).

So in teaching practice, the quick readability of QR code provides much convenience and mobility to curriculum. For example, if students are required to submit their assignments in hard copies, they may not be able to clarify certain abstract issues through the use of traditional sentences but need a presentation composed of multimedia files. Therefore, they could attach a QR code linking to animation or video they designed as a supplement to the answer when they submit final works. With QR code, the instructor could view students’ answers as soon as he/she takes a photo and decodes QR code via a code reader. On the contrary, if a student only inserts a URL of his/her design in the paper, the instructor has to start his computer, log on the Internet, and may download and view document in the specific program. Compared to latter method, QR code does provide a significantly quicker readability for instructors and students.

**Abundant Information Load**

One QR code can handle up to 7089 characters of text information (letters, numbers or symbols in the Latin alphabet) so that it becomes possible to pack a ton of information, including a URL, message, text or phone number, into a small space. In fact, the information load of QR code is large enough for teachers to send students reading materials, assignment requirements, and resource links, and then give them an interactive reply. In contrast, one SMS message can contain 160 characters at most and a twitter message can carry up to 140 characters.

Practically, the abundant information load of QR code is really a good assistant for instructors. For example, when an instructor intends to share an essay or certain assignment requirements with students via Twitter or SMS messages, the length of information probably exceed the maximum number of characters. Then the post or message will be divided into several pieces and it can be confused for students to track and read. However, it will be convenient for the instructor to encode reading materials, assignment requirements, and resource links in a QR code and send it to students because the length of most materials fits within the maximum load for QR code. What is more important, students could access various formats of multimedia documents rather than boring word narratives. Consequently, an abundant information load of QR code can make the learning more convenient, engaging, and efficient.

**Examples of Integrating QR Code in the Curriculum**

Some instructors have already integrated QR code in the teaching practice as discussed in the following sections. To cater to the trend of educational reform on instructional technologies, many instructors rely more on QR code for its features of the bridge built between online and offline media, being easy to generate, quick readability, and an abundant information load.

**Language Learning Tool**

Based on curriculum-related features, QR code has been widely used as a language-learning tool (Chaisatien & Akahori, 2006). Among all the factors, the success of language learning is limited by the time that students engage in language learning activities outside the classroom and the absence of opportunities and motivation in practical contexts (Liu, Tan, and Chu, 2010). Therefore, researchers expect to construct a context-
aware immersive learning context supported by Augmented Reality (AR) technologies to facilitate language learning. AR is an excellent educational application in terms of its ability to embed digital objects into a real environment (Hughes, Stapleton, Hughes, and Smith, 2005). Liu, et al. (2010) proposed a QR code and AR-supported English learning environment, called Handheld English Language Learning Organization (HELLO). HELLO system relied on the HELLO server and m-Tools and allowed students to acquire context-aware resources with their mobile phones and WLAN. With the detected identification code sent from students’ mobile phone when they took pictures to decrypt QR code, the server located students and sent the context-aware contents back to their phones. HELLO system turned out to be rather feasible and promising in Taiwan after a pilot study (Tan, et al. 2010). For example, if an instructor of English Learning Center (ELC) made a QR code of English reading materials and sent it to the server, students could finish their reading tasks even when they were waiting in lines for their food in the cafeteria. In conclusion, QR code turns out to bring more convenience and mobility to the language learning.

Handout Link
QR code increases the interactivity and readability of paper-based materials when it is printed on the handout for students. As is known, instructors are not able to insert videos or audios directly on the paper-based handout except for texts. If there are some hyperlinks to online resources on the handout, students have to type in these links to view those resources on a computer or mobile devices. However, if the instructor embed those resources in a QR code and attach the code to handouts, students can access them right from handouts.

For instance, an instructor of 10th grade wants his/her students to teach themselves to make a ship model according to the handout he/she delivered. Sometimes, texts and images on the handout may not function well in explaining the exact actions to create the model. Hence, students may be confused by the complicated procedure or certain details in the process. If the instructor places a QR code of tutorial videos on the handout, students can access tutorial videos while building the ship model and the whole process will be much more interesting and impressive and potentially make students more absorbed in the project. It tends to prove that QR code can motivate students’ interests as well as enhance learning outcomes.

Online Poll
Considering its quick readability, QR code is destined to play a significant role in a student’s daily life once it is integrated into education. There are many student associations on campus. To elect the president or chairman for an organization, students usually have to participate in polls to vote for their candidates. These polls are often paper-based, so students are required to be present to complete the electoral procedure. It becomes so inconvenient for students who live off campus, especially those who have to drive a long way to campus in order to vote for candidates. However, if QR code is introduced into the election poll, the procedure might be much simpler. Provided the election poll for president of Instructional Technology Student Association is coming, officers could set up an online poll and insert a QR code linking to the Website on the flyer or in an email to students. Once students could see the QR code either on the flyer or in the email, they can take a picture of the code with their camera-integrated mobile devices which have QR code reader and then the code reader will exactly decode and navigate students to the online poll. Compared with driving a long way to campus, it only takes a student no more than a minute to vote with QR code. Additionally, QR code refrains from the trouble caused by typos in a URL because of its preciseness. Therefore, the quick readability and mobility of QR code ensures it is possible to launch students’ activities even off campus, which is very convenient for distant and mobile learning context.

QR Code’s Future in the Curriculum

Potentials of QR Code in the Curriculum
As discussed above, QR code has a great potential for being integrated into the curriculum. According to Gary and Deborah (2002), education in America has been reforming concerning the integration of instructional technology since the turn of the century. The trend of educational development is to focus more on student-centered instruction, which contains three basic components, including open-ended learning environments, learning context, and collaborative learning.

The open-ended learning environments concentrate on students by means of enabling them to choose their learning contents. In this way, students are truly endowed with the core position in the curriculum. A learning context that a student can understand really helps him to gain a better understanding of what he learns. So in the teaching practice, instructors usually strive to provide students sufficient information they are familiar with as the learning background. When students can be really involved in the context, it becomes much easier for them to master the content. As its name implies, the collaborative learning emphasizes the cooperation among students and
the interaction between instructors and students. In the era of Web 2.0, Web 2.0 tools and augment reality technologies reasonably bring more interactivity to the learning environment and make the learning process more efficient.

The student-centered instruction is gradually dominant in the area of education. Meanwhile, QR code really accords with the trend of educational development considering its relevant characteristics. QR code can assist in constructing an open-ended learning environment relying on the bridge built between the online and offline media. Due to being easy to generate and the quick responsibility, QR code functions well in the process of collaborative learning. Furthermore, an abundant information load enables QR code to contribute to an appropriate learning context for learners.

In addition, QR code itself is also making progress and improving. The next generation of QR code is expected to handle much more information so that users need not connect to the Internet to view contents QR code represents. Just as the name suggests, users could better achieve a quick response with the Quick Response code. In conclusion, QR code, as one application of AR technologies in the era of Web 2.0, can absolutely show promise for the future in education and facilitate the educational development.

Challenges of Using QR Code in the Curriculum

Despite all features that help ensure QR code of a great potential in education, there are some issues that have to be considered when integrating QR code in the curriculum. In order to make the best use of the QR code, people have to understand how to use it properly.

Privacy. QR code provides a public platform of information exchange for users. Anyone who installs a digital camera and a QR code reader in a computer or mobile devices could view resources any QR code represents without limitations because it is not required to log into the account. However, at the same time, the convenience causes a threat to the user’s privacy. The information that is compressed into the barcode is thrown to an open online environment. To protect the user’s privacy, people have to come up with efficient ways that can make the information safe but not counteract the convenience.

Content Safety. QR code allows users to access an abundant information resource, including limitless online materials. Hyperlinks embedded in QR code might navigate users to a Website, which is not appropriate for students. Therefore, when instructors are concentrating on enlarging its information load, they should also pay more attention to the safety of contents behind QR code.

Conclusion

QR code has already been widely widespread in education in addition to industry, commercial activities, and entertainment performances. As a paper-based hyperlink, QR code makes it possible to construct a connection between the online and offline media. The quick readability, an abundant information load, and being easy to generate further contribute to its potential for integrated into the curriculum. Because of its abundant information load, QR code enables users to access a variety of multimedia materials which could help students to gain more instructions from paper-based learning materials. At the same time, QR code also brings about much more convenience, mobility, interaction, engagement, and efficiency to the learning context.

Current education is in the process of a reform featured with the use of instructional technology (Gary & Deborah, 2002). Based on its features, QR code jibes with the trend of educational development towards student-centered instruction. Furthermore, QR code itself is also on the approach of improvement. Undoubtedly, QR code has a great potential for being integrated in the curriculum. However, in the meanwhile of its rapid development, some issues and concerns, such as privacy and content safety, should be considered for its further promotion in education. People should concentrate more efforts on research to develop safer and faster ways of QR code usage. Only in this way, people could finally achieve the quick response with Quick Response code in the curriculum.
References