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## Survey on QR Codes in Instructional Design

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**ABSTRACT:** QR code or Quick Response code is a specific matrix barcode (or two-dimensional code) that is readable by dedicated QR barcode readers and camera telephone and , used for storing data like web links, text and email addresses and other digital content. With the ever increasing popularity and advances of the mobile technology , the use of tablets and smartphones have become the integral part of learning and teaching experience . QR Codes though popular in advertising and marketing domains, are slowly taking steps into the foray of traditional methods of education delivery and learning . QR Codes can be integrated with instructional design to bring more life and innovation into the classroom .

**KEYWORDS:** QR Codes , Quick Response Codes, Learning Methods , Innovation , Education.

### I. INTRODUCTION

According to digital design company Zabisco , 90% of information transmitted to the brain is visual, visuals are processed 60,000 times faster in the brain than text and 40% of people will respond better to visual information than plain text. So it makes perfect sense for simple internet based links to be replaced with QR Codes in specific places and applications. QR code or Quick Response code is a specific matrix barcode (or two-dimensional code) that is readable by dedicated QR barcode readers and camera telephones. The code consists of black modules arranged in a square pattern on a white background. When scanned with the camera of a mobile device such as an iPad, Android tablet or smartphone they can transfer web links, text and email addresses and other digital content quickly and easily to users.

QR Codes are already getting increasingly popular with advertisers and marketing companies as they provide an immediate means and prospect to visit a website to find out more information about a range of products and services. These codes storing Uniform Resource Locators(URLs) can be pasted almost anywhere ; magazines , signboards , visiting cards etc . They create links between web resources and physical world. This is termed as hard-linking or object hyper-linking. Job advertisements can be seen with QR codes from recruiters. QR codes are network aware smart objects that connect the physical world to the digital world. The QR codes not only allow users to take the action instantly but also offer a way to store the information in the most personal device which people carry all the time.

“As technology continues to develop in all spheres of life, this not only increases its potential for use within the lecture room and beyond – but also our expectation that this will happen.” National Student Forum Annual Report 2009. Mobile learning and technology is more readily integrated within classroom settings today. QR codes can be used as an innovative method to grab a student's attention and make the normally mundane classroom teaching and education delivery more interactive. Educators can integrate QR codes into their regular teaching activities and bring novelty and innovation to the classroom whether traditional or virtual.

### II. TECHNOLOGIES THAT INFLUENCE THE FUTURE OF HIGHER EDUCATION

“Don't ask what the technology can do for you, rather what the pedagogy needs.” Gilly Salmon, Professor of e-Learning and Learning Technologies, University of Leicester. With the ever increasing popularity and advances of mobile technology, the use of tablets and smartphones has become an integral part of teaching and learning. These are slowly taking over the traditional methods of education delivery and learning methods [1].

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According to the 2012 NMC Horizon Report released by the *New Media Consortium* and the *Educause Learning Initiative*, the six major technologies that will bring a paradigm shift to the face of the classroom in this decade are Mobile Apps, Tablet computing, Game-based learning, Learning analytics, Gesture-based computing and Internet of Things [2].

Malcolm Brown, Director of the Educause Learning Initiative said in a statement: “Identifying the key emerging technologies for learning is vital at a time when all institutions are forced to make very careful choices about investments in technology. The Horizon Report goes beyond simply naming technologies; it offers examples of how they are being used, which serves to demonstrate their potential. The report also identifies the trends and challenges that will be key for learning across all adoption horizons. This makes the Horizon Report essential for anyone planning the future of learning at their institution.”

Technology is enabling our need to be mobile. We would love to ensure that our learning and teaching methods go hand-in-hand with this lifestyle. According to a report from Ericsson, by 2015, 80 percent of people accessing the Internet worldwide will be doing so from a mobile device. Mobile applications are slowly becoming so common place that their potential and viability for use in academics is becoming more evident. With the resources so readily available to both students and teachers, more and more number of students are seen using mobile apps for anything from note-taking to learning a new language, checking a timetable or sharing a file [3]. Tablets with blending features of laptops and smartphones, applications and Internet access are creating a niche market for themselves especially among students and academic circles. Students are already using tablets in some schools and colleges and this trend is going to be on the rise as long the use of digital content in education is also on the rise. Many of the educational institutions are distributing tablets and i-pads to students to enable and encourage students to learn in the connected environment. This trend is catching up even in developing countries like India.

All web 2.0 tools like podcasting, twitter, RSS feeds all lead to creation of enormous amount of data. Learning analytics is a broad term that defines the way in which this educational data can be collected, transferred and analyzed in relation to students and decision making related to their progress. Educational Institutions are increasingly using Learning Management Systems (LMS) that accumulate enormous amount of data pertaining to academic records, assignments, exam results and extra-curricular activities which all form the basis for future performance predictions. All this data can be collected, analyzed and used to create educational opportunities to cater to an individual's needs and abilities.

Game based learning is being visualized and developed to encourage learning which is goal-orientated, promotes social skills, team work, and collaborative problem solving. Gesture-based computing is already in vogue with the proliferation of smartphones and devices that use gestures such as touch and swipe as access mechanisms - a clear deviation from traditional keypad and mouse method.

'Internet of Things' is another concept which is slowly catching up. It is a means to portray network-aware smart objects that connect the physical world with the world of digital information and communication. The key attributes of these 'things' are, a unique identifier, information storage capabilities, ease of connection and the capacity to communicate with an external device when required . Quick Response Code is one such 'thing'.

The key trends and challenges identified by the report will be key for future of learning and teaching. There is a continuous conflict between online learning versus campus-based programs, with the online learning methods and programs clearly eroding traditional learning methods. Education Institutions are re-evaluating their paradigms and adapting to accommodate online learning, 'hybrid' learning and collaborative models. Students spend time on the Internet, learning and exchanging information through various platforms, irrespective of the academic circles. It has become imperative for the institutions to be part of the competitive and changing education scenario. With study materials easily available in digital formats and ability to collaborate directly with the faculty online is making hybrid learning a very attractive prospect for students who want the flexibility to learn , earn and work . A constant increase is seen in the number of students involved in self-learning through self investment . In order to remain in the competitive

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environment, many universities who were once permitting only full-time enrollment are slowly joining the bandwagon and offering degrees that can be acquired through distance education mode.

Cloud based computing allow users to be able to share files and collaborate quickly and effectively. Student centric education methods are getting popular where the student is more pro-active than the teacher. This allows the student the flexibility to devote attention to a topic independently as per requirements regardless of how the faculty is dealing with the course. Today, as work too has become more collaborative and team based, it is imperative that the student products are also structured in the same manner. Consequently, various tools like Google Docs, Skype, social networks and wikis are seen to be used increasingly for educational purposes .

### III. HOW DO YOU CREATE AND WORK WITH QUICK RESPONSE CODES?

A QR code is a barcode which can be read by webcams or smart phones. In its simplest sense, it is "print based hypertext link". Actually we simply encode a URL into the QR Code and then point a mobile phone (or other camera-enabled mobile) at it. The device has to have a QR Code decoding software installed on it, it will fire up its browser and go straight to that URL. The scanning device will respond by opening up the correct application to handle the encoded data appropriately through the Function Code One(FNC1) application identifiers that are embedded in the encoded data. The FNC1 is an invisible character used to identify and separate fields for variable length application identifiers.

Most smartphones will have a mobile barcode scanner which will read QR codes. Otherwise the user needs to download a free app, such as QR Droid or Red Laser on to the smartphone , to scan the barcode. When the barcode is scanned, information that is embedded in the code appears on the phone screen or camera-ready mobile device . This information can be in the form of text, a web address, an email address, SMS message, a phone number or even a video. QR codes can be generated easily , using any website such as QRStuff [4] .

There are various ways of creating QR Codes. One can use sites such as qrstuff.com or QR-code-generator.com or apps like QR Code Maker and QRafter for iOS and QR Droid for Android. Adding QR Coder bookmarklet [5] by Russel Tarr aids to create a QR Code from the browser in a single tap or click. One can even add it to Safari on the iPad. i-nigma [6] is a good app for scanning QR codes as it is very quick and available on different platforms. A QR Code sent as an email attachment, can be saved to any device and can be used with the scan app for iOS and Android to read it.

QR Codes are the same all over the world, since they follow the technical specifications specified by the ISO-18004 standard. Apart from the data a code contains, the only other significant difference between codes is the number of modules required to store the data. A Version 1 QR Code is a 21x21 array of data elements with the array increasing in size by 4 modules for each increase in version number. The largest standard QR Code is a Version 40 symbol that 177x177 modules in size and can hold up 4296 characters of alphanumeric data (theoretically) compared to 25 characters for a Version 1 QR Code. ([www.QRStuff.comm](http://www.QRStuff.comm))

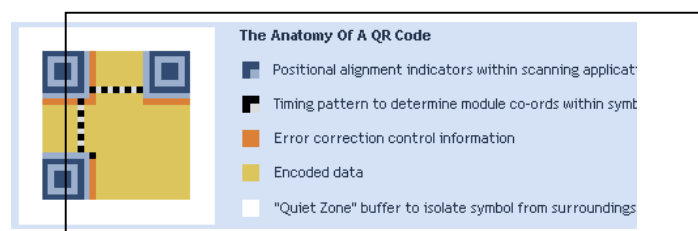


Fig. 1. Anatomy of a QR Code, Ref. [www.QRStuff.comm](http://www.QRStuff.comm)

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The correct decoding of the codes is crucial and is directly dependent on the resolution of the camera-enabled portable device. With the average present-day devices, it has been seen that Version 5 or above (37x37) there is a risk of incorrect decoding of the QR code. A QR Code also contains its own error correction data, internal (Fig. 1) orientation calibration and self-alignment markers. For this reason, even if the QR code is upside down or wrapped around a curved surface, the message will still be accessed correctly without getting hampered. So Codes that are intended to be used with mobile phones, it is always better to use the Version 4 or lower, and a QR Code symbol of at least 2cm across.

## IV. QR CODES IN INSTRUCTIONAL DESIGN

Andrew Miller(2011) Educational Consultant and Online Educator in his blog says, “As mobile learning becomes more and more prevalent, we must find effective ways to leverage mobile tools in the classroom. As always, the tool must fit the need. Mobile learning can create both the tool and the need. With safe and specific structures, mobile learning tools can harness the excitement of technology with the purpose of effective instruction. Using QR codes for instruction is one example of this”[7]. Stephanie Geyer(2010) in her blog on use of QR codes on higher education lists advertising upcoming classes, linking to schools Facebook page, and creating one to two question surveys that can be accessed through QR codes as some of the ways these codes can be used to connect to students. QR codes can be a great voting tool allowing students to vote by simply scanning the code as they enter or exit the classroom (Miller,2011).

Today, we are a very printing happy community, who love to print and distribute reading materials. Instead of distributing printouts to individual students, they can be given a QR code that takes them to the instructions, course materials, announcements or assignments on the website. Newsletters can include QR codes that may announce awareness programmes like blood donation camps, parent-teacher meetings, sports, technical and cultural carnivals in the campus instead of distributing pamphlets for every event separately. It can not only save paper, space on the display boards but also promote a message of eco-friendliness.

Almost all institutions are focused on placement support to the students and hence technical writing and resume creation is vital at some point of the course duration. The training and placement cells can benefit a lot if they can get the students to use QR codes to create resumes that link to other content such as their professional website or portfolio. Thus aiding in greater accessibility by the recruiting firms and organizations. Normal PowerPoint presentations or slide share sessions can use QR codes that are linked to various resources. The students can directly access the resources as the presentation is being delivered. It would not be necessary to display the URLs or for the student to remember the URLs.

A lot of time can be saved if research scholars can add QR codes to their reports connecting them directly to the online resources like published papers or their thesis reports. Such codes can be used on display boards also, so that anyone interested to access the material can do so directly. QR codes need not be very specific to study of computer science. You can bring the web into the non-ICT classroom. It can be used as easily in any field. Exhibits of any kind, whether an artifact in geology, a piece of art or a specimen in biology, can be tagged with a QR code that can link it to online information about it or other works by the same author or exhibitor.

QR codes can be used extensively during document verification process of counseling sessions. The process of admission into engineering and other technical courses through Central Seat Allocation Board(CSAB) or State counseling requires numerous documents of scores of students to be verified on a daily basis. In the Indian context, documents and certificates pertaining to caste, category, income etc are required to be verified online from their respective websites as a check for validity. If QR codes are generated and included on these certificates, they can be verified much quicker than the current system which involves a counseling center officer going online and verifying each one by accessing the websites. The Indian government has started using this QR initiative by attaching a QR code on the Aadhar (a card that acts a sort of social security card in India cards. The Central Board of Secondary Examination(CBSE), India also has included such codes on some of the Joint Engineering Examinations(JEE) main documents.

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The continuous leaps in technology can be alarming and disconcerting to the teachers of higher education. But they have to be a part of this ever changing scenario and learn to innovate rapidly to keep pace with the times. "There are infinite uses of computer and new age technology, but if teachers do not bring them to the classroom and make it work, then it fails."- Nancy Kassebaum.

## V. CONCLUSION

According to digital design company Zabisco[17], 40% of people will respond better to visual information than plain text, this means that image content is king. QR codes are more innovative than simple hyperlinks. The prime advantages of QR Code is that it can be read anywhere ,anytime, which allows the target audience to easily browse through their smartphones as they carry it all the time and its really easy.

Real world implementations by many educators are seen in the areas of URL shortening service, international recruitment events, and using codes that include google analytics tracking code information. It is just a matter of time, that this simple pattern will gain widespread use in education. The only stumbling block for it gaining popularity in developing countries is the requirement of a smartphone or camera-ready and web- enabled device always at hand. But the steep decrease in the internet service rates and the ready availability of cheaper versions of smartphones in these countries like India are seen as a great support to the popularization of use of QR codes. QR codes are here to stay. It is left to the educators to see how this code can be brought to widespread use in education.

"Technology is just a tool. In terms of getting kids together and motivating them, the teacher is the most important", - Bill Gates.

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