IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 24, Issue 7, Ser. 2 (July. 2019) 46-51
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Technological Intervention in Science Pedagogy: Quick Response Codes (QRCS)

Dr. Jyotsna A Amin
Assistant Professor,Department of Education(CASE),Faculty of Education and Psychology,
The Maharaja Sayajirao University of Baroda, VadodaraGujarat -390019

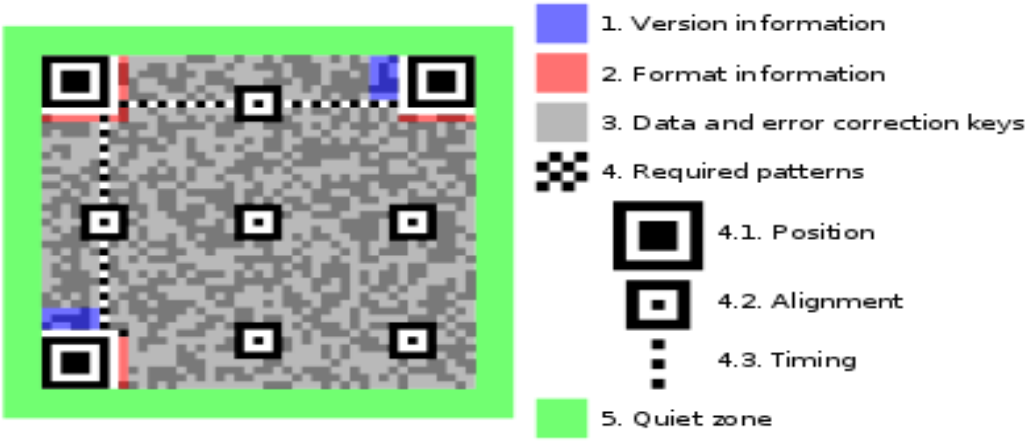
Date of Submission: 27-06-2019 Date of acceptance: 13-07-2019

I. INTRODUCTION

The world is rapidly moving towards the advanced technological era. The field of education has been slow to recognize both the impact of new learning tools and the environmental changes in what it means to learn. However, the rapid changing world has impacted the lives of people and the way they communicate in last few years. With the pace it is changing, it requires rethinking learning, learning tool and learning management systems with future perspectives. With the growing awareness about TPACK, MOOCs MOODLEs, and various online learning platforms it is imperative for the teachers to think in this direction. In order to connect the learners, the most promising handy gadgets are mobile, IPads, tablets to adult learners and now with young learners too. In the report of Statistica, (2015) it was predicted that for 2017 the number of mobile phone users in India could be rise to 730.7 **million**. In this same year the number of smartphone users in India was predicted to reach 340**million** and could reach almost 468 **million** by 2021. For 2017, the number of smartphone users in India was estimated to reach 299.24 million, with the number of smartphone users worldwide forecast to exceed 2.3 billion users by that time. The number of smartphone users worldwide is projected to amount to nearly **2.7 billion** by 2019. Since 2017, Government of India has started distributing **Namo-E-tab,** tablets to the learners at higher education level. Soon it will reach to school level also. Many of the private schools do provided these facilities to their young learners. Various mobile learning applications have been introduced to school education to connect the learners. There are many private institutions who offer online coaching, digital learning tools through android applications. This has created an environment for the entry of mobile in the school system also. **Quick Response code**(QR)one of the creative and most promising learning tools to meet the diverse needs of the learners in this technological era. This paper explores the possibilities of using QR codes in the field of Education in general and Science education in particular. The author being in the field of science teacher training since fifteen years, has further shared experience of implementing QR codes in science teaching learning at teacher training level. It further provides suggestions and put forth certain challenges in doing so.

Quick Response Codes; Origin and structure

QR Codes were created in 1994 by Denso Wave, a Japanese subsidiary in the Toyota Group. The use of this technology is now free. The QR Code is not the only two-dimensional barcode in market, another example is the Data Matrix code.



Source : https://www.qr-code-generator.com/

QR Code is the most famous 2D barcode in the world. It has gained its success in Japan since the 2000s where he is now a standard. In 2011, an average of 5 QR Codes were scanned daily by each Japanese - more than the average number of SMS sent!In 2010 QR Codes started to expand in the USA then in Europe where they can notably be seen in advertisements.

A QR Code is a two-dimensional square barcode which can store encoded data. Most of the time the data is a link to a website (URL). Specifically, a QR Code extends the data at disposal on any physical object and create a digital extent to marketing operations. This technology enables and speeds up the use of mobile web services: it is a very creative digital tool.

QRCodesconsistofblackmodulesarrangedinasquarepatternonawhitebackground. They are designed to decode the data quickly.Itisquiteeasytocreate and usethese codes(Pons,2011). There are other codes also which are used along with it are ztec Code, Micro QR Code, Data matrix and Microsoft Tag different types of codes.

Static QR codes, the most common type, are used to disseminate information to the general public. They are often displayed in advertising materials in the environment (such as billboards and posters), on television and in newspapers and magazines. The code's creator can track information about the number of times a code was scanned, and its associated action taken, along with the times of scans and the operating system of the devices that scanned it.

Dynamic QR codes (sometimes referred to as unique QR codes) offer more functionality. The owner can edit the code at any time and can target a specific individual for personalized marketing. Such codes can track more specific information, including the scanners names and email address, how many times they scanned the code and, in conjunction with tracking codes on a website, conversion rates.

QR code scanner and generator

In order to create QR codes many free QR code generator soft wares are available. Then it has options to choose the type of content to convert in QRC i.e. pdf file, business-card, picture, URL, video link, address, account number. Once we enter the data in the form appearing on screen it will generate a QR code for it. It is always desirable to consider dynamic QR code. One can customize it in terms of color, size, shape etc. in order to test the generated QR code you can use software QR code scanner and reader. The idea of the QR code is that it is a simple a way to access a URL (i.e. a web address). A QR code is an image file (it can be a png, jpg, etc.) that when scanned by a QR Code reader will access the URL it links to, which typically means it will open a web page. According to MobiLens (2011), one outoffivesmart-phoneownersinU.S.scanned QR codes.Canada and Germanybothsawnear16%ofsmart-phoneownersscanningQRcodesinamonth,while theUKandSpain(hometothemostpenetratedsmart-phonemarkets)sawjust12%oftheir participantsscanningQRcodes.(Source:comScoreMobiLens,3mon.avg.endingDec-2011) QRcodesareusedinawiderangeofareaslikemedia,streetbanners,allplacesleadingto websites,music,videoandsocialnetworks(Arslan,2011).AccordingtoWalshandAndrew (2011),someofthebeneficialusesofQRCodesincludebridging printed materials to electronicmaterials,reachingvoicedmaterials,openingembeddedvideos,providinglibraries withexternalresourcesandreachingappropriatehelp.

Studies conducted in the area of use of QR Codes in Education

Review of therelatedliteraturerevealedthatmobiledevice wasusedwhileusing QR Codes. **Liu,TanandChu(2007),** developedalearningsystemto improvelearners'Englishlanguagelevelswiththehelpof QRCodes.Thestudyrevealedthat theQRCodesystemhelpedlearnEnglish. **Rivers (2010)**designedatask basedQRCodesystemforEnglishlanguageteaching.Inthestudy, theresearcherexplainedhowthesystemwasdeveloped,appliedandtested.Itwasfoundin thestudythatthelearnersenjoyedandbenefitedfromthesystemwhileusingittocarryout thecourseactivities.

Al-Khalifa(2011), developedaMobileSnapshotResponsesystemwithQRCodes.Thesystem aimed at helping improvethecommunicationbetweenteachersandtheirstudents. **Chen,Teng,Lee&Kinshuk (2011)** conductedastudytoallowaccesstodigitalmaterials throughQRCodesinpaper-basedreadingtasks and reported that directaccessto digitalresourcesusingQRcodesdoesnotsignificantlyinfluencestudents'reading comprehension. **Hwang,Wu,TsengandHuang(2011),**developedalearningplatformusingQRcodesviacell phones which arelow-priced, having acameraand internet connection&found that the learners who use the platformdemonstrated meaningful improvementsintermsoflearningefficiencyandlearningachievement.

Rikala & Kankaanranta (2012), conducted a study on blending classroom teaching and learning with QR codes in education. The results of the study revealed that the learners were eager and motivated to use the QR codes. In addition, in the study, it was found that QR codes could motivate learners and draw their attention to class since these codes support learning and provide opportunities both for independent learning and for cooperative learning.

Inanotherstudycarriedoutby**McCabeandTedesco(2012),**QRcodeswereusedviasmart phonesfordirectconnectionwiththesubjectswithinthescopeofthecourseofmathematics. The study revealed that Eighty-three percent learners' states that they could prepare well, could complete homework more productively. 67%ofthemstatedthattherewasanincreaseintheircoursemarks& it is easy to useQRcodes.83%ofthelearnerexperiencedlessstresswhentheystudied forthelessonswiththehelpofQRcodes.

Durak Ozkeskin & Ataizi (2016) conducted a study entitled QR Codes in education and communications to study the impact the redesigning the QR code enabled lessons in teaching. Learners participated in the study reported that they were aware of the QR code, so it was easy for them to use it. They also reported that such features such as visual element, attractiveness and direct routing had positive impact on learning.

In a nutshell, it can be inferred from the studies referred above that except one study all the studies have shown positive results for the integrating QR codes in Classrooms. Hence, it is desirable to integrate QR code in various subjects and in science teaching particularly. In the proceeding section various ways to integrate in science education is indicated.

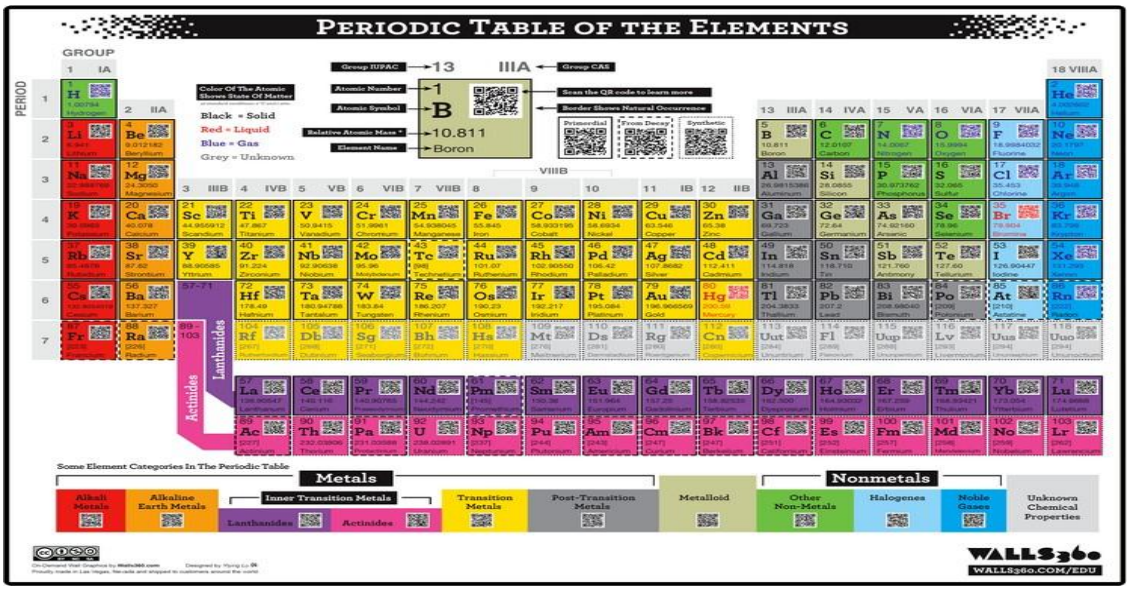
Integrating QR codes in Science Education:

QR codes are becoming popular because of its access anywhere, any time with smart gadget mobile, iPad, tablet which are part of our lives now. Theory of Connectivism also gives emphasis on connecting learners with the learning environment rather than teaching.Science has wider scope of using them in science classroom.

Multimedia Content based textbook

A popular use for QR codes in science is to add multimedia content to hard copy pages of science textbooks. With the help of pdf exchange editor one can print QR code in the e-textbooks. For printed version a teacher can put a paper having QR code as tag having connection with the content students are reading. QR Codes can be used to link to online narrated and animated stories and also to short factual clips related to the science concepts explained in the textbook. It is a digital age initiation that in many states like Chandigarh, Tamilnadu and Uttar Pradesh, Gujarat is planning to publish the state textbooks with QR codes linked with the video-based lessons to you-tube or NIOS under the project **Energizing textbook**from academic year 2019-20. They have planned to embed the QR codes in the textbooks which can be linked with interactive videos, audios, power-points presentations, science experiments, other related documents, exercises, quizzes. Many of the privet publication textbooks of lower primary classes have already started doing so.

Teachers can Generate QR codes that link to videos, websites or information sheets about the topic or theme. Or Print poster-size codes to use in the center of a display, or in a special location in the classrooms e learning platforms. The below example of the periodic table where each of the elements have been replaced with QR codes. Each code links to a YouTube video discussing the element in question.



Source :https://2d-code.co.uk/qr-code-periodic-table/

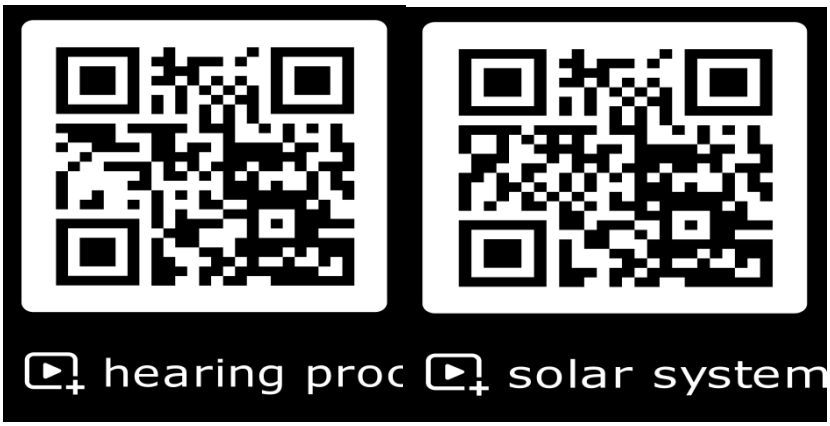
Arousing interest for learning: Teacher can decorate the classroom walls with learning aids that are embedded with QR codes. Where few questions are written, and then linked QR code is given for their answers. This can be done for creating their knowledge about latest happenings, about various scientist and their pictures linked with their life history, their major contribution etc.

QR enabled Assignment: In order to provide homework to the students' teachers can create a worksheet and provide a QR code and share with the parental communication applications.Create QR codes that link to the specific strategies or information needed to support students understanding about the concept taught in the class. A QR code can be linked to it which has answers to the given worksheet to strengthen their knowledge and provide instant feed-back about the home work they have done.

Practical work: Science teachers can pre-record the video lecture indicating the tasks to be done by students and connect it with the QR code. This practical work can be classifying the given objects, classification of metals, non-metals etc.

Virtual tour: while teaching about the diversity or micro-organism around a particular geographical location teacher can Generate QR codes that when scanned, provide clues about a certain location from around the world he wants to teach. Place these around the classroom, or on google classroom. Provide students with a map where they can plot their trip around the world as they work through each of the clues, finding the next location for studying life science topics.

Energizing Charts and Models: Teachers frequently use charts and models while teaching in classrooms. A QR code link can be generated and can be pasted to respective charts and models where video link or further information about the picture, diagram can arouse curiosity in the learners. i.e. beneath the model of EYE a video link about the internal structure of eye can be given with QR code. Below are the exemplary QR codes generated for the above given example.



Energizing Science laboratories:

In secondary science laboratory for each of the classification specimen QR code stickers can be generated. It can Place QR codes on the different parts of a model e.g. a skeleton, a simple machine or globe. Provide students with a variety of definitions on cards or on a worksheet.Students scan the QR codes to reveal the name of that part and match the name to the definitions. In higher secondary classes while dealing with larger Indian classrooms where manual /procedure hand out can be attached with QR code to avoid rush around it.

Enriching science libraries: QR codes can be created for specific books, linking to reviews, trailers or additional resources then printed on to stickers and stuck inside the cover of the book. Students can scan and learn more about the book before they choose to read it. After reading students can be asked to prepare their own book review, scientific aspects covered in it. It can be posted to blog or wiki and linked to the physical book via QR code.

Project based learning Integrate QR with a PBL or Science Learning project where students can create the codes that will link to the content they create. If students helped create awareness around spreading germs, for example, they might put the codes around the school or in a parent newsletter. They can take it a step further by creating codes for a local business or organization.

Make Learning Stations

Science teachers can convert every corner of the class with codes that will take students to different online activities, videos or content. Using a great tool like the discussion protocol of reciprocal teaching (PDF) or a graphic organizer will help facilitate their interaction with the linked content.

Extended Science knowledge for gifted and slow learners:

Teachers can provide optional activities for students who want to excel is to simply put the code on the class assignment and let them follow it to the extension activity or question. It won't take up much space and might

facilitate a little excitement about the extension assignment. This can help both the groups one who needs practice can have access to it again and again and the gifted can read and understand at their pace. One can provide additional scaffolding with a link to a recitation or focused questions to get them started.

QR code for assessment for learning

Science teachers can create video-based questions, quizzes, worksheets and question papers and share them with the learners to check their understanding about the concept taught in the classroom.

Experience of Integrating QR codes in Science Classroom at B.Ed. level.

Science is taught as one of the pedagogy subjects at Bachelor of Education (B.Ed.) programme at B.Ed. level. Student teachers are given learning experiences to enable them to integrate technological knowledge, content knowledge and pedagogical knowledge (TPACK). For that various initiatives such as formation of online group at google, using mobile networking for educational purpose and the latest initiation is crating Google classroom. Though all this platform QR code is also used as one of the important tools to share knowledge about content, pedagogy and methods.

Above are the sample QR codes used by the author to provide information about the various aspects such as:sharing content knowledge, pedagogical knowledge, technological knowledge, Assessment purpose/class-test, link to various learning platform as as google classroom of the group and for the feedback purpose.

Practical issues in using QR codes

Accessing QR code-linked information requires the user to have a working mobile device equipped with a camera and a QR code scanner app (or the ability to download one). Users may not always have their mobile devices where QR codes are provided. In other words, just because you own a cell phone doesn't mean you always carry it with you to a conference presentation or on a hike in a park or wildlife refuge. As mentioned earlier, it may also be beneficial for scientific authors to include QR codes in their peer-reviewed articles to provide access to datasets or software code. A potential limitation to this idea is that the reader may only access this supplementary information on their mobile device. An extra step is then required to transfer the information onto a computer and view it more comprehensively. Many websites are not currently mobile friendly, which exacerbates the need to transfer QR code content to a computer. Furthermore, linking a QR code to content that was not thoughtfully developed to communicate the intended message detracts from the usefulness of the technology, or worse, confuses the user's understanding of the topic.

II. CONCLUSION

Science teaching has wider scope in integrating QR code as assistive tool for self-directed. It can help create engagement in a lesson, manage classroom, be part of student work or facilitate inquiry in a project. If it is used wisely can help teacher , parents and students for ensuring science learning , making it more meaningful and academic endeavor. Training science teachers using the codes can really take science learning to a leap in this technological era.

REFERENCES

[1]. Al-Khalifa, H.S., (2008). Mobile SRS: A classroom communication and assessment service, Innovations in Information

[2]. Cheung, W. S., and Hew, K. F.,(2009). A review of research methodologies used in studies on mobile handheld devices in K-12 and higher education settings. Australasian Journal of Educational Technology, 25(2), pp. 153-183.

[3]. Crompton, H.(2013). A Historical Overview of M-Learning: Toward Learner-Centered Education. In Z. Berge & L. in Muilenburg (Eds.), Handbook of mobile learning (pp. 3-14). Routledge, NewYork, USA.
[4]. Gurhan D. , Emre E. & Murat (2016). QR Codes in education and communication in turkishOnlineJournalofDistanceEducation-TOJDEISSN1302-6488Volume:17Number:2Article4
[5]. Hwang, G., and Tsai, C., (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. British Journal of Educational Technology, 42(4), pp. E65-E70.
[6]. Hwang, G., and Tsai, C., 2011. Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. British Journal of Educational Technology, 42(4), pp. E65-E70.
[7]. Law,C.&So,S.(2010).QRcodesineducation.JournalofEducationalTechnology
[8]. DevelopmentandExchange,3(1),85-100.
[9]. Ozcelik,E.,&Acarturk,C.(2011).Reducingthespatialdistancebetweenprinted& onlineinformationsourcesbymeansofmobiletechnologyenhanceslearning: Using2Dbarcodes.Computers&Education,57(3),2077–2085.
[10]. Rikala,J.,&Kankaanranta,M.(2012).TheUseofQuickResponseCodesintheClassroom. In11thConferenceonMobileandContextualLearning(pp.148-155).
[11]. Rivers,D.J.(2010).UtilizingtheQuickResponse(QR)CodewithinaJapaneseEFL environment.J.JaltCallSig,5:15-28.
[12]. So,S.(2008).AStudyontheAcceptanceofMobilePhonesforTeachingandLearning withagroupofPre-serviceteachersinHongKong.JournalofEducational TechnologyDevelopmentandExchange,1(1),81-92.
[13]. http://www.ceebl.manchester.ac.uk/events/archive/aligningcollaborativelearning/Siemens.pdf
[14]. http://www.teachhub.com/technology-classroom-using-qr-codes
[15]. https://aquila.usm.edu/cgi/viewcontent.cgi?article=1011&context=jetde
[16]. https://whatis.techtarget.com/definition/QR-code-quick-response-code
[17]. https://www.edutopia.org/blog/QR-codes-teaching-andrew-miller
[18]. https://www.innovativeeducation.org/blog/big-question-qr-codes-to-engage-students
[19]. https://www.scienceandmathwithmrslau.com/2018/03/5-ways-use-qr-codes-classroom/

Dr. Jyotsna A Amin." Technological Intervention in Science Pedagogy: Quick Response Codes (QRCS). " IOSR Journal of Humanities and Social Science (IOSR-JHSS). vol. 24 no. 07, 2019, pp. 46-51