

# Employing QR Code as an Effective Educational Tool for Quick Access to Sources of Kindergarten Concepts

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**Abstract**—This study discusses a simple solution for the problem of shortage in learning resources for kindergarten teachers. Occasionally, kindergarten teachers cannot access proper resources by usual search methods as libraries or search engines. Furthermore, these methods require a long time and efforts for preparing. The study is expected to facilitate accessing learning resources. Moreover, it suggests a potential direction for using QR code inside the classroom. The present work proposes that QR code can be used for digitizing kindergarten curriculums and accessing various learning resources. It investigates using QR code for saving information related to the concepts which kindergarten teachers use in the current educational situation. The researchers have established a guide for kindergarten teachers based on the Egyptian official curriculum. The guide provides different learning resources for each scientific and mathematical concept in the curriculum, and each learning resource is represented as a QR code image that contains its URL. Therefore, kindergarten teachers can use smartphone applications for reading QR codes and displaying the related learning resources for students immediately. The guide has been provided to a group of 108 teachers for using inside their classrooms. The results showed that the teachers approved the guide, and gave a good response.

**Keywords**—Kindergarten, child, learning resources, QR code, smart phone, mobile.

## I. INTRODUCTION

QUICK Response Code (Fig. 2), QR code for short, is a matrix barcode invented by the Japanese corporation Denso Wave. It can encode information in 2D direction, therefore it holds up much more data than a barcode (Fig. 1). QR codes can be used to access learning sources and increase the interactivity in lesson materials. At the moment, there are many free QR code applications for mobiles and computers operating systems. These applications have designed for creating, capturing and reading QR code images. By scanning a QR code image using devices, information, including text and links, can be accessed.

The researchers have preferred to use QR code which exceeds barcode in popularity in some areas, because QR code images holds between 4000 and 7000 characters of information, whereas barcode image holds only 20 characters. Furthermore, QR codes can encode the same amount of data in one tenth the space of a barcode. Moreover, reading QR codes does not require to be scanned from one particular angle, it can be read regardless of their positioning [9].

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Fig. 1 Barcode



Fig. 2 QR code

QR code has become a proper tool for effective and fast communicate URLs to users, particularly with the increase of using in the area of mobile internet access. Moreover, this allows products, such as magazines, business cards, newspapers, signs, and T-shirts, which accept the print of QR code images to be used as carriers for online product adverts [6].

### A. Mobile Phones in Education

Mobile phone can be used to assist classical and modern educational approaches [14]. Mobile-assisted language learning [1], MALL or m-learning, is learning with mobile phones which can be applied in any location which is covered with transmission signals. Generally, the models used on m-learning are deduced from the earlier models of learning as constructivism and social constructivism [15].

Project-based learning is one of the models that integrates with smart phone in useful ways, students are allowed to develop the content and share real problem-based, and inquiry-based learning using smart phones. Siemens' theory of Connectivism [16] is another approach that involved connection making and technology as activities for learning. It integrates constructivist approach and connectivism approach which provides students a chance to acquire modern skills as technology-mediated multi-tasking

### B. Using QR Code and Mobile Learning

In education, QR code can be used as a part of mobile learning; it has been applied as a tool for learning languages [5]. For example, [11] has developed HELLO system or Handheld English Language Learning Organization system.

The system suggested a QR code and an Augmented Reality supported English learning environment. It depends on a server for allowing students to obtain context-aware resources with their smart phones. The system can locate students by identifying the code which was sent by students' smart phone when they took photos to decrypt QR code. Thereafter, it sends the context-aware contents back to their smart phones. In addition, HELLO system has become to be rather possible to work in Taiwan [11]. Consequently, QR code is convenient and more mobility for language learning. For instance, when an English instructor sends a QR code for a reading material to the server, students can easily do the task even if they were outside classrooms.

Recent research shows that digital contents tend to improve students' motivation [10], achievement [7], and attention [12]. Screens have been a stimulating condition to do the basic internet navigation tasks [8], and educational related tasks [13]. QR code is considered as a useful technology to provide fast and easy access to multimedia learning resources, and there are some examples for using QR code in education:

- Display embedded information immediately [3].
- Browsing internet website resources [4].
- It can be connected with library catalogue [2].
- Submission of assignment sheets [2].

## II.METHOD

QR code usually uses for storing URLs, addresses and several types of data on posters, signs, and business cards. This approach has a large number of potential applications [9]. The current work introduces a model for learning using QR code as an educational mediator. The study suggests that QR code can be considered as a mediator for learning resources for kindergarten teachers. In this work, the researchers used QR code to store the URLs of learning resources. They have established a learning resource guide for kindergarten teachers based on the Egyptian official curriculum. The guide focuses on the scientific and mathematical concepts, and provides some learning resources for each concept, where each learning resource URL is represented as a QR code image. For example, (Fig. 3) shows four QR code images for learning resources related to the term "Magnet". Therefore, kindergarten teachers can use smartphone applications for reading QR code images and displaying the learning resources immediately for students.

The researchers have designed a questionnaire for measuring the stratification extent of teachers about using the proposed guide as a tool for education. The questionnaire includes two aspects: using the QR code guide and efficiency of the guide activities. (Table I) represents the questionnaire

## III.RESULTS AND DISCUSSION

The researchers have introduced the guide to a group of 108 kindergarten teachers from 19 different schools. The teachers used the guide for a month, and the researchers applied the questionnaire before and after using the guide. The teachers agreement percentage are demonstrated in (Table II) and (Fig.

4), moreover (Table III) and (Fig. 5) show the overall questionnaire result.

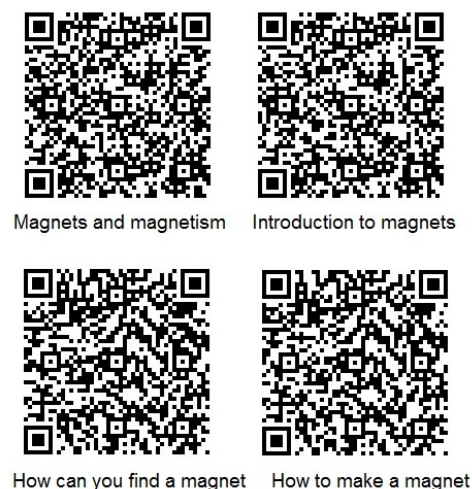


Fig. 3 QR codes for learning resources related to "Magnet"

TABLE I  
THE QR CODE GUIDE QUESTIONNAIRE ITEMS

Item	Aspect
1 Using the guide is easy	
2 The speed of accessing information	
3 Using the guide during lessons does not dissipate kindergarten teachers	Using the QR code guide
4 QR code is an effective tool for accessing the learning sources	
5 The activities attract the students' attention	
6 The activities cover the aspects of the curriculum	The guide activities efficiency
7 The activities are various	
8 The activities benefit students	

TABLE II  
THE RESULT OF APPLYING THE QR CODE GUIDE QUESTIONNAIRE

Item	Agreement percentage		
	before applying	after applying	Difference
1 Using the guide is easy	63.52%	94.35%	30.83%
2 The speed of accessing information	73.54%	98.92%	25.38%
3 Using the guide during lessons does not dissipate teachers	62.85%	95.49%	32.64%
4 QR code is an effective tool for accessing the learning sources	72.48%	92.55%	20.07%
5 The activities attract the students' attention	79.10%	98.12%	19.02%
6 The activities cover the aspects of the curriculum	80.66%	86.54%	5.88%
7 The activities are various	70.54%	93.46%	22.92%
8 The activities benefit students	85.55%	96.85%	11.30%

The results demonstrate that the agreement of the teachers about the guide before using it was much lower than their agreement about the activities. The reason that some kindergarten teachers were worried about using the guide during lessons particularly old teachers who are not familiar with using technology. However, they trusted the efficiency of the presented activities. Before applying the guide, the

teachers thought that they could not use the guide correctly because they would dissipate. But after using the guide, they found that it was simple and effective.

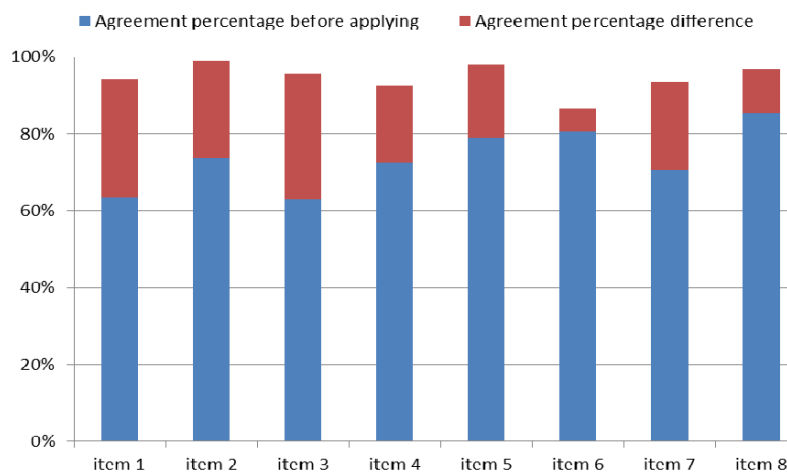


Fig. 4 Items agreement percentage

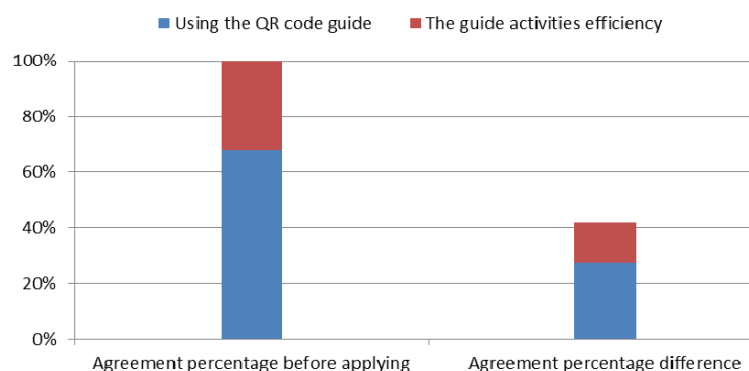


Fig. 5 Overall agreement percentage

TABLE III  
THE OVERALL QUESTIONNAIRE RESULT

Aspect number	Aspect	Agreement percentage		
		before applying	after applying	Difference
1	Using the QR code guide	68.10%	95.33%	27.23%
2	The guide activities efficiency	78.96%	93.74%	14.78%
Total		73.53%	94.54%	21.01%

Generally, the teachers became satisfied about the guide and the activities, however, the results show that the guide needs more effort for covering the all curriculum sides. The researchers recommend forming a permanent committee of experts for updating the guide annually according to the curriculum changes and the available resources on the internet.

During working with kindergarten teachers and schools, the researchers have addressed some problems related to poor schools and teachers:

1. The internet connection fee for mobile phone is not cheap for some kindergarten teachers.
2. Old mobile phones have some difficulties in reading QR codes due to focus, brightness, and screen size.

3. Old kindergarten teachers are not qualified enough for using mobile and internet technologies.

Finally, the researchers have suggested some recommendations which would help kindergarten teachers to overcome the difficulties.

1. Schools should provide an internet access with a high speed to kindergarten classrooms.
2. Schools should provide computers with cameras attached with a wide LCD screen or projector to kindergarten classrooms.
3. Forming teams for updating the guide annually, according to the latest internet resources.

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