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THE PEDAGOGICAL POTENTIAL OF QR CODES AS A DIGITAL TOOL FOR STUDENT LEARNING

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Abstract

Introduction. The article examines the concept of the "QR code," characterises its specific features and possible applications. In the present day, there is a tendency toward the rapid growth of information volumes; consequently, the swift retrieval of information becomes critically important, as it enables the instant perception and analysis of a message. Under such conditions, the QR code becomes an effective means of obtaining the necessary information.

It is noted that the QR code is easy to use, as it is recognised by the standard camera of a mobile device, as well as by a dedicated application, simply by pointing the camera at the code image and reading the encoded information.

The article observes that the precursor to the QR code is the barcode, which caused inconvenience during its use, as it could only encode a very limited volume of information.

It is stated that QR codes are not licensed; therefore, anyone can create them using special software, thereby simplifying the learning process, which involves the continuous processing and retention of specific information.

Furthermore, QR codes are actively used by educators and students alike for the systematisation of information, its correct interpretation, and the conservation of time spent searching for the necessary theoretical material.

It has been demonstrated that the use of QR codes in the educational process not only facilitates and accelerates information retrieval, but also enhances students' motivation to learn, as they gain the opportunity to verify the effectiveness of implementing innovative digital technologies — an aspect of growing relevance during the period of distance learning.

A multifaceted analysis is provided of the possibilities for incorporating QR codes into the educational process, namely: embedding links to multimedia resources; presenting collections of links and informational blocks; and applying assessment and testing materials in the form of task cards with varied assignment options.

Aim. To explore the pedagogical potential of QR codes in the context of education digitalization, to identify the main directions of their practical application in the educational process, and to justify their use as an effective digital tool for enhancing students' cognitive engagement and increasing learning motivation.

Keywords: QR code; digital technologies; barcode; educational process; mobile learning.

A brief description of the state of knowledge. The rapid development of high-speed mobile internet and portable devices has opened up vast opportunities for the world. At this stage, an educational trend known as Mobile Learning is actively developing, and with it the QR code — the use of which enables the educational process to become mobile, that is, no longer tied to a stationary computer [6, 7].

A QR code (from the English - quick response) is an image composed of squares filled with a specific pattern, developed by the Japanese company Denso-Wave in 1994 [2]. A QR (Quick Response) code is a two-dimensional, square-shaped barcode that typically contains three large positioning squares located in its corners. These positioning markers enable scanning software to detect the code, determine its orientation, and compensate for geometric distortions during decoding. The remaining matrix consists of encoded data that can store various types of information.

In general, it is a matrix code (a two-dimensional barcode) that can be readily recognised by the standard camera of a mobile device equipped with a dedicated application. To read the code, one need only point the camera at the code image. A single small square can encode 1–2 pages of A4-format text.

The most common data formats stored in QR codes are:

- web addresses — upon scanning the code, the user is directed to an internet resource without the need to manually enter the website address;
- contact details — enables the immediate saving of contact information to a phone or computer address book;
- email addresses — the QR code may contain an email address and the name of the recipient;
- SMS — upon scanning, the user receives a pre-composed message ready to be sent;
- cartographic information — encoding of geographic data, enabling the location of an object to be viewed in services such as Google Maps;
- telephone numbers — scanning such a code enables the user to immediately place a call to a person or organisation [2].

The precursor to the QR code is the once-popular linear one-dimensional barcode, which was used primarily in commerce and contained brief information about a product. The principal drawback of this encoding method was the small volume of information it could accommodate. For example, the most common linear code of the EAN-13 type contained only 13 characters.

Today, QR codes can be found virtually everywhere: on websites, advertising billboards, business cards, and product packaging. They fully meet the modern requirements for receiving and disseminating information, making the process convenient, fast, and interactive [1].

Since QR codes are not licensed, anyone can not only use but also create them free of charge. For this purpose, a multitude of online services and applications have been developed that allow codes to be saved in various graphic formats (*.jpeg, *.png, *.tiff), printed, sent by email, or published on the internet. Although creating a QR code using various services is straightforward, there are certain nuances to be aware of when encoding hyperlinks [2, 5].

Web page addresses in textual form are very long and contain a large number of characters; accordingly, the QR code of such a link is complex and may be read incorrectly by

a mobile device. To avoid this problem, it is preferable to use URL shortening services, such as bitly, tinyURL, short.io.

Codes can be recognised using:

- the camera of a mobile device;
- a webcam and computer/laptop software (bcWEBcam);
- an online service or application into which a graphic image containing the QR code can be uploaded, or a link to the page with the code provided (ZXing, Decoder Online, bcTester) [4].

Contemporary students can scarcely imagine life without a smartphone. Each day they search, process, accumulate, and transmit information, converting it from one form to another. Therefore, the application of technologies that use mobile phones for various types of information processing can, firstly, assist educators in their teaching activities and, secondly, engage students and increase their motivation to study a given discipline.

Let us consider the various possibilities for using QR codes in the educational process:

- QR codes can embed links to multimedia resources that students may find useful when completing a specific learning task. Printed codes can be distributed for students to glue into their lecture notebooks.
- When organising project-based activities, QR codes can be used to present collections of links, informational blocks, and comments.
- QR codes containing web links to internet resources and safety instructions can be displayed on information boards in classrooms and laboratories — not only in text form, but also as video or multimedia commentary.
- Assessment and testing material in the form of task cards with varied assignments can also be presented as QR codes. For this purpose, the dedicated online service ClassTools.net is available. During classes, online surveys can be conducted using mobile phones: students scan the survey QR code, then quickly respond and express their opinions. Registration with this service is not required. It features automatic construction of frequency diagrams for the most common responses and supports export of survey results in Excel format.
- One means of individualising learning may be homework assignments encrypted in QR codes. This reduces the likelihood of copying and increases students' interest in completing the assignments.
- QR codes can be placed on paper and electronic business cards and student badges [3],[5].

Codes can be used anywhere — on an ordinary sheet of paper as well as on large information boards. A unique opportunity has emerged to organise everything around oneself so that both educator and student find the experience comfortable and convenient. Moreover, what previously hindered the educational process (phones in students' hands) can now be turned to advantage [6].

Conclusion: It must be acknowledged that the QR code is no longer merely a "trend" but has been in active use for a considerable period of time. It is simple and convenient to use, and the number of potential applications is limitless — depending solely on the educator's imagination. The code can be effectively utilised in any informational space within an educational institution, including: in the educational process itself — mobile lessons, links to course websites, surveys, recording of speech (when studying a foreign language); in administrative work — timetables, business cards, staff working hours, information exchange; and in extracurricular activities — quizzes, quests, and games. In the educational process, it is an effective method for engaging students in learning and cognitive activity, as the 21st century is the century of advanced information technologies, and most young people possess a variety of devices that enable them to quickly scan and obtain all the necessary information.

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