THE USAGE OF QUICK RESPONSE CODES: EVOLUTION AND INTEGRATION IN CLASSROOM ACTIVITIES IN THE CONTEXT OF LANGUAGE LEARNING

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The aim of this research is the exploration of the appearance, development, evolution of the Quick Response (QR-codes) and the feasibility of their using in the context of modern education. The authors of this article have shown that QR-codes can be interpreted as specific codes that are quickly readable by smartphones. QR-codes allow connection of real objects with any additional web content. Scanning QR-codes conveys a wide multitude of information, in particular educational materials. The paper emphasizes that over the past years QR-codes have a wide range of uses across all types of industries and other spheres, specifically retail, marketing, advertising and logistics, etc. The authors have shown that the use of QR-codes in the field of education can be interesting and accessible in the context of the relevance of learning with the using of modern devices, and mobile learning. The research shows that the implementation of the modern technologies can contribute to the learning visible outcomes. The research presents the prerequisites and algorithm for the successful and methodically motivated use of QR-codes in education, especially language learning. It is noted, that QR-codes make it possible to combine educational material with additional web content, traditional learning environment with virtual. The attention is paid to technical means that provide access to encoded educational information. It is noted, that students must have special smartphones, cameras and a corresponding mobile application, downloaded to the phone for the successful using of QR-codes. The technical component contributes to the successful completing of assignments with QR-codes. In this context, applications that allow the combination of digital and physical information in real time through the use of mobile devices have special relevance. The technical characteristics of this tool in education can get extra motivation in students, since it involves a game in a natural format for them. In addition, the article presents the results of an experiment, conducted to clarify the purposes and areas of the use of QR-codes, applying them to access educational content

Keywords: QR-codes, mobile learning, higher education, foreign student, Ukrainian Language as a Foreign

1. Introduction

«In the context of rapid development and improvement of the national educational industry, the problem of introducing pedagogical innovation into the educational process is particularly acute» [1]. The study of QR codes in the educational process can be placed in the context of the introduction of Advanced Information and Communication Technologies into the present-day educational space, its significant modifications, purposeful implementation of different cutting-edge techniques in teaching and wider use of the Internet.

Technology today is turning the old learning techniques on their head. They have changed the way people search for information, save it and pass it on to others. Smart devices and mobile phones have completely taken over traditional ways of teaching students. The effective and harnessing incorporation of the most advanced information and communication technologies is one of the most important tasks of the educational system today. Key task of modern teachers is to introduce and continue

to make steady progress on the implementation of educational technologies. Therefore, it is crucial to accomplish a balanced integration of latest techniques and traditional practices in the teaching process.

2. Literary review

Regardless of the fact that profound transformations of the educational system and mobile learning have been conducted all over the world few studies have addressed the use of QR codes in education

These researches describe the essence and features of QR codes, briefly present their appearances, transformations, offer ways of their rational use in teaching pupils and students, describe their own experience, entirely explore the impact of QR codes and mobile devices on students' learning outcomes, reveal and analyze the teacher and student perspective of using the quick response code [2, 3]. They successfully describe the usage of flipped classrooms in higher education [4]. Researchers also describe ways/benefits of utilizing

QR codes in education and communication and the using of QR codes in the educational process [5, 6]. In addition, the authors focus on code integration in classroom activities [7, 8].

Despite their potential benefits, the topic of using QR codes in classrooms is still extremely relevant today.

There is a great need for more research on the integration of QR into the Ukrainian educational space. The methodological bases of research on this topic enhance and diversify articles by Ukrainian didactics, in particular they analyze the degree of study of QR codes in the scientific literature, identify historical features, uses, highlight the content of information encoding, point out the difference between static and dynamic submission of output data, examine the forms of organization of learning activities using two-dimensional barcodes, and also describe and present examples of the use of this tool in the educational process by teachers of higher education institutions [9]; consider the possibilities of using codes in the educational process, in particular, explore the advantages and disadvantages of their use in the educational process [10, 11], and examine the forms of organization of learning activities using two-dimensional barcodes, describe and present examples of the use of this tool in the educational process by teachers of higher education institutions [12].

In addition to this, the issue of implementing QR-codes as a component of a modern textbook has been considered, and the relevance of introducing QR-codes into the content of Ukrainian language textbooks has been substantiated [13]; key features of the introduction of mobile learning: perspectives, advantages and disadvantages also have been shown [14]. The essence, functions and specifics of using QR-codes in the educational segment have become the object of analysis by representatives of interdisciplinary directions [15, 16].

At the same time, the lots of questions are still unexplored and available theoretical basis needs clarification and generalization.

In this research we concentrate on the process and impact of the implementation of the QR codes and mobile devices in foreign language learning. We also focus on the process of its appearance, creation, and implementation of QR codes into lessons, their modification and transformation into effective training tools. We emphasize on the Internet using development, utilizing QR codes, while studying the Ukrainian language with foreign students in the contest of general medical education in Ukraine.

3. The aim and objectives of the study.

The aim of the study was to analyze the essence of QR codes and the basic features of their implementation into the modern process of language learning.

To achieve the aim, the following objectives are set-up:

1. to describe and summarize what the main stages of QR codes' development are;

2. to identify and describe the main ways of QR codes' implementation into education as the assessment tools;

3. to suggest and characterize possible aims and most frequently used ways of QR codes' utilizing in language teaching.

4. Materials and Methods

This research is a descriptive study to find out and analyze the essence of QR codes and the key features of their using in the educational context. Basic – the general method of scientific description. The descriptive-analytical method was used to analyze and systematize the features of QR codes (research questions 1 and 2). For the preparation of the, article generalization, systematization, classification, interpretation of scientific facts were also involved (research questions 3, 4 and 5).

The research method was the Questionnaire-based survey that provides further calculation of data. The purpose of the questionnaire was to assess the frequency of use, possible aims and places of QR codes' use by students.

To confirm this assumption, we did a survey and we asked students, how often do they use QR codes? We also questioned them about possible aims or places of their using. The participants in the survey were 80 students from the Faculty of Medicine and the Faculty of Dentistry of the Poltava State Medical University in the academic year of 2021–2022 (the first semester). Students of 1–4 years took part in the survey. It should be noted, that the survey was anonymous and the students gave their full consent. Survey participants provided answers to the questions, recorded in the questionnaire. They had to choose one of the proposed options, which reflected the frequency of use of codes in their daily lives. The following answers were proposed among the options: *«very frequently», «frequently», «relatively frequently», «very little», «not at all».*

In addition, the participants were asked about the scope and purpose to use QR codes. The interviewed students did not have any restrictions on possible answers. They had the opportunity to present both full and short answers, add explanations, necessary arguments, examples, etc. The most frequently mentioned answer options were grouped and represented on the chart by color segments. After data processing and manipulations with the calculations, the main areas and purposes of using QR codes were identified. Descriptive statistics were calculated to answer research questions 4.

5. Result and discussion
5. 1. Theoretical part of the study

The Quick Response (QR) code has recently become one of the most popular and publicly assessable ways of extracting necessary information; its decoding and further easy sharing. It is commonly known, that the barcode scanners can effortlessly consider the information, encoded in the QR code, while scanning the data. Large number of multimedia applications, particularly labeled street view images, consumer photos, video streaming, news notes, different instructions, dinner choices, menus, tickets, etc. simply adds QR codes to help readers to easily disseminate and understand some related information. It suggested people's ability to access the Internet anywhere, which makes it possible to surf the Internet for all necessary information at any time people need, because in today's online world, everything is linked together. It is, therefore, not surprising or astonishing, that a simple click makes everything possible and accessible. The real world becomes clicka-

ble if someone points the phone at the QR code. Nowadays people can work without any restriction of place and utilize their modern devices for a variety of purposes. QR codes are all over the place and hardly a day goes by without seeing one.

Of course, it wasn't always like that. Looking back, we should admit, that by the 1980s, the barcode system was commonly used. It primarily involves retail trade, manufacturing and distribution. A barcode, which consists of few bars and spaces, can be defined as a machine-readable representation of numerals and specific symbols.

Later more detailed production control was required at manufacturing sites due to a shift from mass manufacturing of one type of goods or products. With regard to the general growth of using barcodes, one that had increased capacity was required. Very importantly, each barcode could store only 20 alphabetic characters. Due to this fact workers had to scan even more than 1,000 barcodes per day. It had a negative impact on the labor force and their expected outputs.

To solve this problem as quickly as possible, a development team, led by Masahiro Hara, was puzzled by developing a new 2D code system with only two parts. They were perplexed by making 2D codes readable as fast as feasible. It was more difficult for scanners to recognize the location of a 2D code than that of a barcode. Regardless, after some negotiation and tries their efforts have been rewarded with great success. Creating 2D code was based on the idea of adding to the code information that indicates its location

A key feature of the barcodes is its capacity to decode necessary information only in the transverse direction/one dimension. 2D codes can effortlessly decode information in both the transverse and longitudinal directions (two dimensions) as the substitute for this. It was supposed, that by including this pattern into a 2D code, the scanning of data could correctly recognize the code and do it momentarily. Another unmet requirement was related to false decoding. And in the moment it was clear, that the incorrect recognition could easily cause a lot more damage. In order to avoid incorrect recognition, the appropriate ratio of white to black areas was found.

Scanners became able to identify the code regardless of the scanning angle by finding the correct ratio due to providing sophisticated manipulation with black and white areas. In particular, scientists began a comprehensive survey of the ratio of white to black areas.

Different pictures and elements, symbols, printed on leaflets, magazines, cardboard boxes, corrugated cartons and other documents after reducing them to patterns with black and white areas were analyzed. They tried to identify the ratio that least appeared on the printed matter. Finally, it was specified as 1:1:3:1:1. The updated and improved code can store a large amount of information. Additionally, it can be read at more than 10 times the speed of the previous version of other codes. So, the modern QR code consists of different areas that are reserved for specific purposes, such as finder, separator, timing patterns, alignment patterns and functional patterns. All QR codes consist of diversity of information areas, and it can be easily divided into few data symbols, which make it usable to print.

Nowadays QR codes are widely utilized. They are frequently used in media content, advertising and marketing, Internet space, specifically in web sites, music, video and social networks. Quick response codes have been applied in fields of marketing, advertisements, education, and library management and in print medium. It is unbelievable, but manageable on the contrary, that the QR code can keep more than 7000 characters in one symbol.

Since 2011, using QR codes has been applied in different forms, such as piece of long multilingual text, a linked URL, an automated SMS, etc. Some of the favorable exploitation of QR codes involves relocation of printed materials to electronic materials, getting voiced materials, reaching embedded videos, providing libraries with external resources and receiving all necessary assistance at any time.

«Now students are constantly use modern gadgets and live in a digital space, so they can easily remember algorithms for using software, frequently use information technology that help to memorize the material» [9]. The active usage of QR codes in education moved into the implementation stage a bit later. This process was generally carried out in the field of mobile learning. We concur with the generally accepted idea that modern technology today is drastically modifying the traditional learning system, unearthing few newest dimensions of learning for students. Due to the fact that mobile phones have completely taken over our lives, smart devices became an integral part of the current educational space. Mobile Learning in education is transforming learning for digital natives. Because of the latest technological developments, the ways, in which we learn and share knowledge, are becoming progressively more multidimensional and multiuse. So, noteworthy is that «The essential role of the Internet has led to an increase amount of the cutting-edge ways, methods and technologies for improving of the approaches of the present-day educational system» [16].

Easy access to the Internet for learning and other educational development purposes was facilitated by the ubiquitous utilization of QR codes. With the handy availability of QR codes, students today can use mobile technologies to access different course materials and activities. In this regard educators must find ways to take advantage of mobile devices' huge educative capability and hidden potential. Therefore, more than ever before, teachers require a space where students are constantly engaged with. One of the requested, frequently used and effective methods for students to gain evident benefits of their mobile devices is through the use of QR codes.

We emphasize on the development of technical support for the registration of QR codes and the description of the algorithm for using them, while studying the Ukrainian language with foreign students in the context of general medical education. At the same time, it can be successfully utilized in secondary schools and higher educational institution as well.

Studying of scientific-methodical practices and special practical information of utilizing QR-codes gave us the opportunity to clarify the technical functions, in particular motivational, informational, educational, re-

flective, control functions, systematization of data, etc. QR codes not only allow tutors store and represent a large number of text or digital information in any language and in any form, but also make learning exciting and interactive.

Graphic codes are an effective and reasonable addition to the offline or online studying as well as an integral part of extracurricular activities. Using QR codes teachers try to inspire and motivate everyone attending, encourage their students to learn the national language of the country where they live and study and to adapt to the Ukrainian life system, and convince them to expand their knowledge of Ukraine's historical and cultural realities.

QR code and its application are incorporated by educational institutions to enhance their services. Tutors utilize QR code technology to share their documents and ease the data entry process. According to K. Degtiareva, «For these links you can provide a variety of information, such as additional, optional, the list of functions, focused on repetition, systematization, generalization» [17].

G. Durak, E. Ozkeskin, and M. Ataizi further illustrated the use of QR codes in education as an assessment tool: «Like class management, QR Code helps teachers in administrative matters, such as providing contact information from educators to students, making exam schedules, marking the identity of equipment in the class» [18].

Researches by [18] showed students' perceptions of the impact of QR codes in supporting learning. The results of the review suggested the codes were seen by students an effective and uncomplicated way to access online instructional materials. Consequently, practicum activities can be more interesting if using QR codes, for example, language field practicum activities.

From our view exercises based on the QR code scanning technology can be used at different stages of lessons to address the challenges of the newest educational items and to promote heightening of students' interest in the subjects studied, developing their hidden potential and assisting them on the path of building their own creativity. This way of presenting educational materials is aimed at the value and emotional development of students, the formation of their internal motivation, understanding the effectiveness of each word in the text. For example, foreign medical students and future dentists can be invited to listen to the dialogues, texts, and podcasts and perform tasks, do thematic crosswords, puzzles, anagrams, learning online materials using the generated QR-code.

In the same vein, we encourage the teaching staff to continue using QR codes for traditional/modern visual didactic content, specifically tag clouds, multimedia presentations, video and audio files, online educational content, infographics, information stands, etc. Likewise we attach importance to increasing use of QR codes to provide standardized tests for measuring students' learning achievement, linked to the national curriculum.

We conducted a study to allow access to educational materials through QR codes in paper-based reading tasks. Another very important point is the introduction of the QR codes in the textbooks, which have designed and published just for studying of different disciplines with modern students, specifically foreign.

Such textbooks systematize a large number of theoretical points necessary for those students who have chosen their profession and should be able do tasks using QR codes. The authors of the textbook give QR codes, by which students have accesses to all texts, exercises, rules and information blocks, dialogues, important theoretical points, etc. This latest form of presentation of educational material is welcomed by students and, of course, is consistent with the principles of novelty, accessibility and emotionality.

Talking about language learning we must mention that students can easily express thoughts, basic communicative intentions and plans by means of the Ukrainian language. Moreover, they should use modern Ukrainian literary language, its styles, and genres in all types of speech activity (listening, reading, speaking, and writing). If this is possible, they should, ideally, operate professional terminology at a sufficient level.

Another way to gain access to the coded information is projecting QR codes on a large screen for students to scan with their mobile devices. Whichever way you follow to provide necessary information, QR codes will be permanently available. Most mobile devices now are provided with a QR code scanner, but there are several free apps available for download.

A closer look at the qualitative data reveals few difficulties that may impede the effective integration of QR codes in teaching. Therefore, it can also impact on student attitudes. Little earlier more students were against QR codes in classes, so they mentioned problems with Internet speed and access to it. They complained that not all mobile phones could scan the codes. Perhaps such reaction can be explained by its novelty and non-adaptability of students to use it properly. The reason for this can also be a lack of awareness and familiarity of the QR code among young people. Having studied the problem, we listed the reasons for non-use of this technology as follows: lack of teachers/academic staff with a sufficient level of technology skills, available alternative forms, an insufficient amount of necessary equipment to use QR codes, etc. Obviously, t*hat situation has been changed* drastically, so *that* we *now* can point with sure to the user's intention to utilize QR code technology at every opportunity.

5. 2. Practical part of the study
A significant number of the respondents (72.8 %) stated in their answers they constantly use QR codes, but only 58 % within the didactic activities. Most of them acknowledge the ability of the QR codes to store various study related information. This is about using QR codes for doing different quizzes, displaying instructional videos, pictures, news and audio, books or even learning modules.

It is worth mentioning, that virtually all participants stated they have good Internet access, most of them have Internet access everywhere, meaning they also have access to mobile technology (tablets, smart phones, laptops, etc.). Only 0.8 % of them do not have Internet access. Fig. 1 shows the degree of using QR codes. Fig. 1 shows the percentage of using QR codes in everyday life.
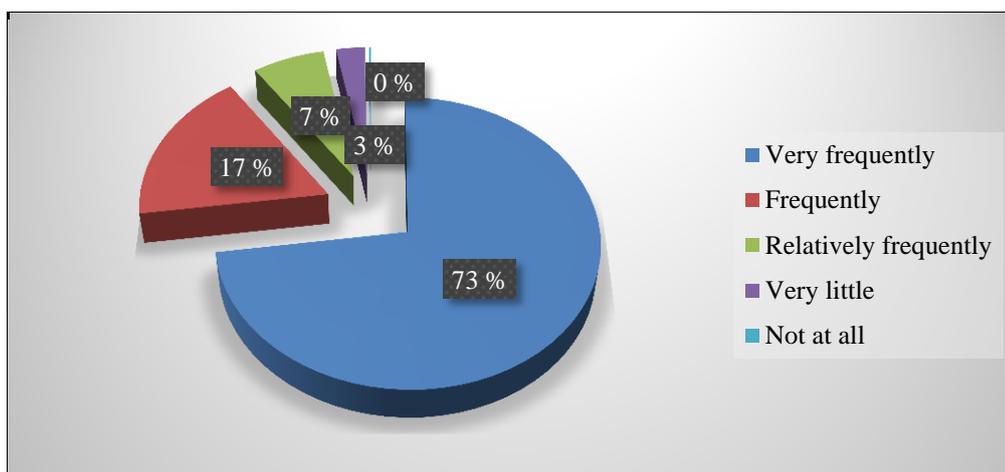
Fig. 1. The degree of using QR codes

After becoming familiar with the data, specifically when the respondents' views about using of QR codes were analyzed, it was found, that students pointed out particular areas where they generally use it. Noteworthy among them are video, images, social networks, audio files, download links, information (surface, deep). Nevertheless, only 37 % of the respondents can utilize QR codes for studying or training. At the same time students agreed that QR codes could be included in the lesson. They are definitely interested in using QR codes in the learning process, and the survey results show that the students gave a positive assessment of the use of the QR code feature in learning.

The use cases from the questionnaire are presented in following Fig. 2.

Utilization of a technology, in particular QR codes, is determined by various factors. To make effective usage of QR codes among students, teachers must organize effective user awareness, programmed orientation, and what is extremely important for the efficiency and effectiveness of its work is to seek to utilize them regularly. In order to improve in the future their abilities and integrate QR codes in the didactic activity teachers require for training information on making QR codes and effective ways to integrate them in the classes. It is thus certainly not redundant for teaching staff to attend training special courses to acquire appropriate skills for creating and implementing QR codes in their everyday life and professional activities.
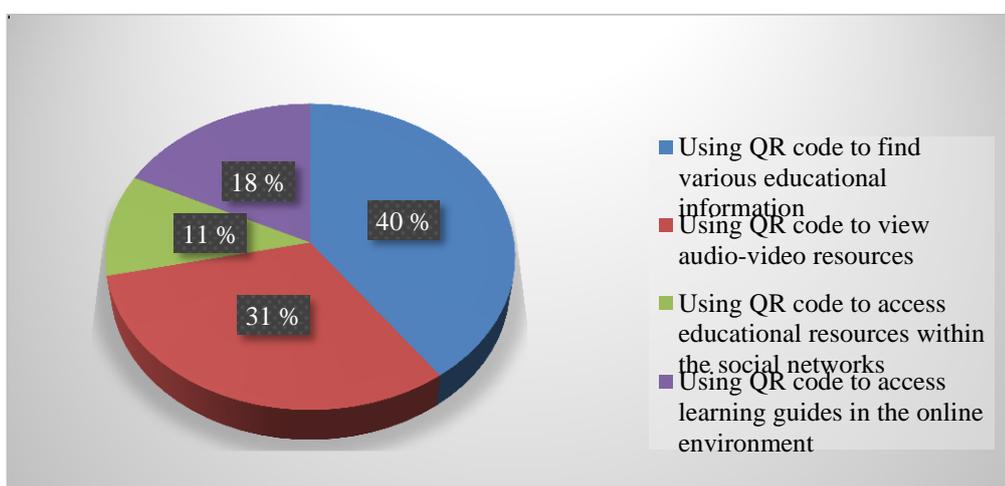

Fig. 2. The use of QR codes in the educational context

Taking the questionnaire data analysis and classroom experience into account, we have identified possible ways to integrate QR codes in the didactic activity. From our view, such attempts to diversify educational content are felt to be more able to attract the attention of students and also the delivery of messages is more memorable because it uses many senses in its application.

First and foremost it can be dissemination of information, required to provide training, particularly web sites

address, e-mail, short voice messages, thematic podcasts, and access to the social media pages of the teacher/course, video materials, web pages or other additional materials, accessing teaching resources within the social networks. Furthermore it can be successfully used as a link to forums, discussion, questionnaires or learning guides in the online, for access to different tasks, control, examination work. QR codes can provide very fast access to QR-quests, QR-quizzes, QR-tours, QR-dominoes, QR-lotto, etc.

This article is an attempt to describe and analyze possible and rational ways/means of using QR codes in the educational process, in particular in the process of studying Ukrainian as a foreign language. The given results and conclusions, depend on a number of objective circumstances, such as the contingent of respondents, their vision of the problem, the material and technical support of students and higher educational institutions. The possibilities and frequency of using QR codes are also conditioned by the preparedness of the teaching staff, their familiarity with the advanced gadgets, digitalization processes, and the Internet access. It also necessary to point on the importance of awareness by the teaching staff of the experiments with modern methods, techniques and teaching aids in order to get better results and to increase the students' interest in studying.

Thus, the prospect of further research is seen in expanding and systematizing ways of using QR codes in modern educational process, in particular language studying, in creating methodological articles that can help teachers disseminate and understand some related information. Detailed study of the specifics of the use of codes for the study of the Ukrainian language by foreign students seems promising and relevant. It is essential to consider the pros and cons of this problem.

6. Conclusion
1. Initially QR codes were developed by Denso Wave to track and control the movement of car components during manufacturing and distribution. With time they have become a widely available and free of cost technology. Since then, the use of these black-and-white pixilated squares has rapidly increased, due to their ability to contain more information than a standard barcode. So, just summing things up, we should point out, that QR codes have passed a fairly fast path from the first simplified barcodes to common in all spheres of public life ways of access to encrypted information. In addition, main distinctive features of the QR codes are moving or operating in a single direction and their high-speed.

2. The availability and prevalence of smart phones with cameras has led to QR codes being applied to a wide range of commercial applications, including marketing, ticket management in transportation, social media applications. Despite the fact that just a few decades ago they were only used in media content, advertising and marketing, Internet space, specifically in web sites, music, video and social networks, nowadays QR codes are frequently used in classrooms and in after classes activities, for homework preparation, self-preparation, testing, self-development, etc.

3. The learning process gradually becomes interesting, varied and distracting. The motivation of students, the desire to learn and self-develop gradually increases.

Having analyzed actual theoretical material, and classroom experience of other researchers, we are considering the possibility of using more effective and interesting ways to insert the QR codes in the didactic activity as successful as in real life. QR codes can be utilized in order to provide information, prepared in advance (QR codes with some accompanying material in the form of articles, research, list of recommended reading; visual material: photos, diagrams, charts, graphs, tables, the presentation of important material, etc.), and access to the social media pages of the teacher/course, video materials, web pages or other additional materials, accessing teaching resources within the social networks. It is also important, that it can be successfully used as a link to forums, discussion, questionnaires or learning guides in the online, for access to different tasks, control, examination work, QR-quests, QR-quizzes, QR-tours, etc.

In conclusion, we may assume that the successful implementation of this depends on the skill and desire of the teacher as well as on the technical base.

Conflicts of interest.
The authors declare that they have no conflicts of interest.

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