

Mobile technologies as a tool to support inclusive learning in higher education institutions

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ABSTRACT

The use of digital technologies in modern educational environments is an urgent requirement. This article aims to study mobile technologies as an effective mechanism for supporting and developing inclusive learning in higher education institutions. To achieve this goal, the article employs methods of scientific content analysis of literature and comparison, which allow for identifying the positive aspects of integrating mobile technologies into inclusive education and the difficulties that exist on this path. The study results indicate a need to utilize both traditional and specialized technologies in the modern higher education landscape. The analysis reveals that traditional technologies supporting inclusion primarily include applications for organizing learning, mobile communication technologies, and applications for creating specialized learning content, including multimedia and virtual technologies for individuals with special educational needs. Among the specialized tools for supporting inclusive learning are apps that enhance vision and hearing. This category also includes mobile applications that support lectures through various subtitle options. The study found that such mobile technologies improve knowledge acquisition and enhance the efficiency of the learning process. It concludes that these applications contribute to greater student integration, reduce social isolation, develop social skills, and increase self-confidence.

Keywords: Digital Tools, Inclusive Education, Higher Educational Institution, Mobile Educational Technologies, Adaptive Methods, Accessibility of Education, Interactive Applications

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1. Introduction

The modern world of mobile technologies has a significant impact on the functioning of society on a global scale, including aspects such as health, safety, and education. Given the rapid development of mobile



applications and digital communication channels, new opportunities are being created to significantly improve the learning process, affecting the rather sensitive area of inclusive education. In particular, according to modern researchers, inclusive education should consist of such elements that all students, regardless of physical, cognitive, or social characteristics, have equal access to educational opportunities, learning resources, special programs, etc. In this context, mobile technologies are a universal tool to support inclusion in higher education institutions.

The use of mobile technologies in the educational process in higher education institutions allows not only the adaptation of educational materials to the needs of different student environments but also the facilitation of active interaction between people with disabilities, teachers, and other students. Modern mobile applications can provide an individualized approach to learning, mainly through adaptive educational platforms that consider each student's level of training and learning characteristics. In addition, modern digital technologies, including mobile applications, make it possible to create an improved adaptive learning environment, which is extremely important for those students with disabilities who have not previously had real access to education. Thus, they can use various specialized programs, making accessing teaching and learning materials easier. Accordingly, the effectiveness of learning will gradually increase.

The issue of inclusion is widely represented in the modern scientific discourse. This is evidenced by modern scientific research on the theoretical foundations of studying inclusion in the education system [1, 2, 3]. However, the issue of implementing inclusion based on modern mobile technologies is less widely represented. Mostly, modern authors have focused on the study of the use of modern innovative tools and techniques in education without focusing on inclusion [4]. However, some authors have delved into this issue. In particular, S. Sprock identified the role of the Moodle platform in ensuring a fair and inclusive environment in the digital age [5]. The author emphasized using this platform to create an inclusive learning space [5]. M. Ozman and C. Gossart also described the main digital technologies contributing to the formation of inclusion in the higher education system [6]. L. Bowen described the role of digital distance platforms to provide access from any location [7]. The author also drew attention to popular platforms' role in organizing learning to ensure inclusion [7]. The study by J. MacArthur presents theoretical thoughts on the peculiarities of researching inclusion in the modern educational space [8]. A. Qvortrup and L. Qvortrup focus on the multidimensional approach to inclusion [9]. The authors describe how inclusion affects different areas of learning, including social, educational, methodological, and psychological [9]. M. Hannan Bin Azhar, T. Islam, and J. Marczak described a new framework for evaluating the usability of applications designed to ensure accessibility [10]. The authors developed a methodology that helps to determine how effectively such applications support users with disabilities [10, 11]. Modern studies also present the role of resources (material and human) in ensuring true inclusive education [12, 13]. K. Mishra and J. Nitha identified the role of rehabilitation in providing students with disabilities with assistive devices to participate in inclusive education. Some authors have also drawn attention to the importance of access to rehabilitation services and technologies that allow such students to be actively involved in learning [14, 15]. Thus, modern authors have drawn attention to various aspects of inclusion; in particular, they have described the theoretical foundations for studying inclusion, assessed the availability of technologies, resource provision of educational institutions, and the role of unique teaching methods in supporting inclusive education. However, the problem of implementing mobile applications to ensure a truly inclusive environment remains open. Therefore, this study will address this gap and characterize the leading mobile applications promoting inclusion.

Therefore, mobile technologies have sufficient potential to increase the level of inclusion in higher education institutions significantly. This will provide students with disabilities with the necessary tools to integrate into learning environments and effectively acquire the necessary theoretical knowledge and practical skills while taking into account their individual needs. The article aims to analyze mobile technologies as a tool to support inclusive learning in higher education institutions. It will also consider the opportunities and challenges

encountered in using mobile technologies in inclusive education in higher education institutions and a detailed consideration of the formation of much more flexible educational environments in the future.

2. Method

The study proposes to use a qualitative approach aimed at analyzing various scientific sources on the proposed issue (articles, publications in online publications, chapters in collective monographs, individual books, and conference proceedings). This allowed for a comprehensive and unbiased coverage of the purpose of the proposed article.

The analysis began with a search for relevant information in scientific and metric databases: Scopus, Web of Science, and Google Scholar. The following keywords were suggested to refine the search: digital tools, mobile learning, educational technologies, adaptive methods, accessibility of education, and interactive applications. The search yielded a total of 2456 results. The first stage was to eliminate all duplicates; as a result, the volume of literature was reduced by 753 items. The second stage involved analyzing the abstracts of scientific articles (or the contents of monographs or chapters in collective monographs), which resulted in 576 results being rejected due to inconsistencies with the aim and objectives of the study. In the third stage, the date range of 2016-2024 was set, which reduced the total number of results by another 456 items. After that, exclusion criteria were applied to scientific literature. In particular, the following markers were considered:

1. The study deals with inclusive higher education and the specifics of digital technologies.
2. The study describes various technologies for adapting the educational process to the requirements of an inclusive higher education institution.
3. The study describes the advantages or disadvantages of using digital technologies in higher education institutions, including the implementation of inclusive education.

Considering Criteria 1, 2, and 3, 39 literature items were left for further analysis.

The study needed to have a regional scope of analysis. In particular, the experience of countries with a high level of inclusive education, as presented in relevant publications, was considered. First, the practices in the United States, European countries (member states of the European Union), Ukraine, the People's Republic of China, and some other Arab and Asian countries were traced.

To analyze the selected literature and consider the relevant existing practices, the content analysis method was applied, which consisted of a detailed consideration of the existing problems and prospects for further overcoming. A scientific comparison method was also used to compare the results with existing practices worldwide, identify standard and distinctive features, and trace the changes in inclusive education due to the widespread use of digital mobile technologies.

3. Results

The term 'special educational needs' was intended to include a broad spectrum of challenges that students from all backgrounds could encounter, whether short-term or long-term [9]. One aspect of a high-quality, rights-based education that emphasizes equity in access and participation and positively addresses each child's unique educational requirements and competencies is inclusive education [8]. Focused on students, inclusive education shifts the burden of adaptation from each student to the educational system.

Ensuring inclusion in the modern educational space has an impact on the implementation of quality education. In addition, it also affects the integration of students into modern learning processes based on innovation and technology. As shown in Figure 1, inclusion affects the individualization of learning. In particular, this approach is essential for adapting curricula to the needs of each student. At the same time, another critical aspect is the enrichment of the learning space [16, 17]. In particular, it is said that the formation of inclusive groups in which different students study, including those with different capabilities, forms a unique learning environment.

In turn, such actions influence the development of social skills, communication skills, empathy, and respect among students [18]. Also, as seen in this Figure, the last important aspect is the improvement of teaching skills. Teachers working in inclusive learning environments use innovative pedagogical techniques and methods [19]. This has the effect of making the learning process more innovative and effective.

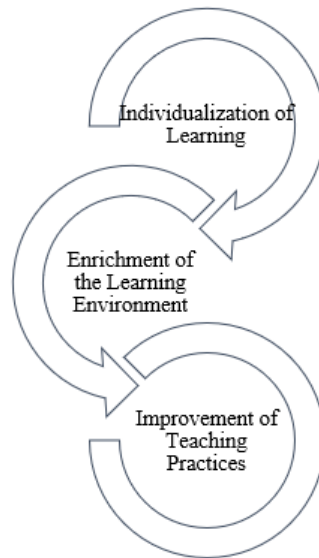


Figure 1. Characteristics of mobile technologies used in higher education institutions

Modern mobile applications have the potential to provide an equitable, inclusive learning environment. They can be divided into two types: traditional tools to support mobile or e-learning and unique applications. The traditional ones include e-textbooks and e-learning resources. In particular, mobile applications such as iBooks play an essential role. They allow students quick access to textbooks, scientific articles, and monographs at any time, regardless of location. This approach dramatically facilitates learning, ensuring that students have all the learning resources at their fingertips. Other necessary mobile resources are learning platforms that provide various online courses [20]. In particular, Coursera, EdX, and Udemy particularly allow students to participate and study at leading educational institutions worldwide. This contributes to developing social skills and language competencies and enhances knowledge in various fields.

On the other hand, learning management systems, such as Google Classroom, Moodle, or Blackboard, provide students with ample opportunities for autonomous learning; in particular, they can view lectures, download materials, submit homework, and participate in discussions without access to a desktop computer [5]. This is especially important for students living in remote areas. It is also essential to pay attention to mobile technologies that facilitate communication. Viber, Telegram, Microsoft Teams, and other platforms play an essential role in this system: they allow all participants in the learning process to quickly exchange information and organize group discussions [21, 22]. These systems also facilitate the formation of constant communication. To ensure a fair and inclusive environment, teachers also need to master a variety of applications for designing and creating learning materials. In particular, mobile versions of Microsoft Office and Google Docs allow for quickly creating and editing documents, presentations, or spreadsheets. Mobile applications designed to work with multimedia also play an essential role [23]. In particular, Canva, AdobeSpark, and other applications allow you to design and create high-quality presentations, graphs, and visual content. This greatly facilitates the perception of information and makes the learning process more exciting and optimized. At the same time, video conferencing applications (Zoom, Google Meet, or Teams) allow you to conduct training sessions, online consultations, additional seminars, or lectures from any location [24]. Virtual laboratories and simulators are essential for students in the technical or medical fields [3]. This allows them to conduct experiments and educational research using virtual technologies. For this reason, such traditional mobile applications play an essential role in the modernization and optimization of the educational process.

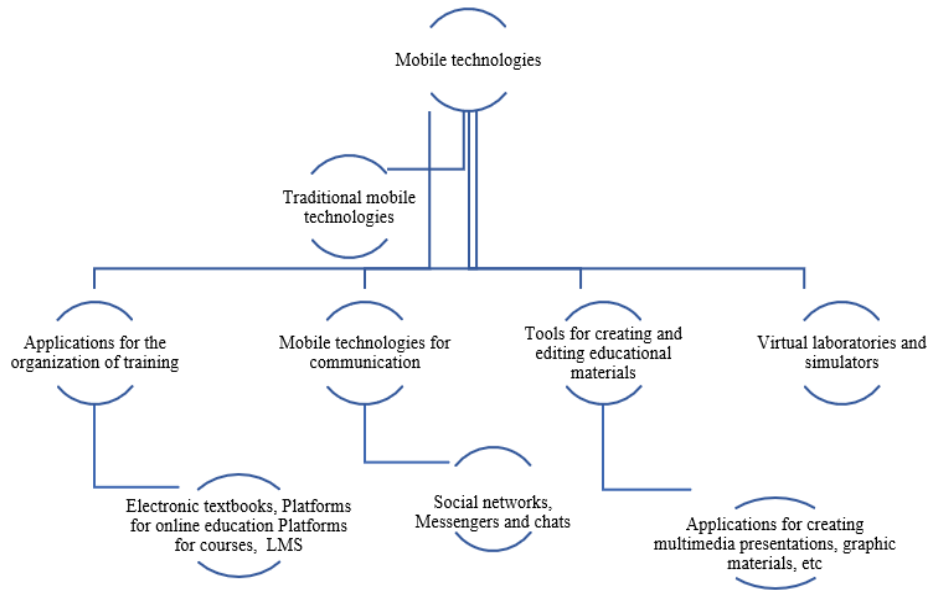


Figure 2. Traditional mobile technologies

On the other hand, the system of special mobile applications includes those that directly affect the organization of inclusion in higher education institutions. In particular, they are essential for those with specific learning needs. For students with visual impairments, teachers use Voice Dream Reader, ClaroSpeak, and Be My Eyes, which are used to generate text-to-speech. At the same time, Voice Dream Reader can read text from various formats (PDF, Word, ePub, and HTML), which allows students to perceive learning materials by ear. ClaroSpeak combines the capabilities of text-to-speech and dictation. It is essential for students with dyslexia and other problems related to reading and writing [25].

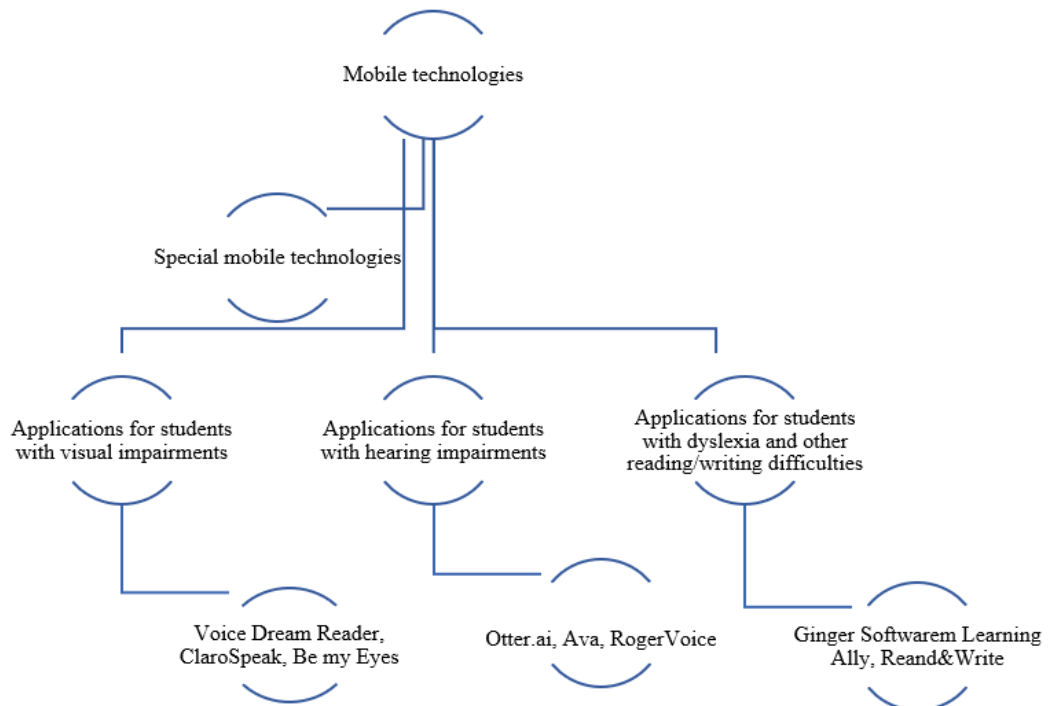


Figure 3. Special mobile technologies

For students with hearing impairments, it is essential to use mobile applications such as Ava (generates quick subtitles that allow students with hearing impairments to effectively comprehend information during lectures, seminars, or communication with teachers), Rogervoice (also provides subtitles through communication via

various messengers or telephone) and Otter.ai (a mobile application that aims to transcribe speech automatically, which transforms lectures into text in real-time) [26]. At the same time, students with dyslexia and other reading/writing problems should be supported by such mobile applications as GingerSoftware (which helps to correct spelling and grammar) and LearningAlly (which contains audiobooks specially adapted for students with dyslexia) [27]. In addition, Read&Write plays an essential role in the support system for dyslexic students, with its various text-to-speech and spell-checking functions.

4. Discussion

Thus, this particular type of application contributes to making the initial process more oriented towards students with special needs and improves access to learning materials and communication between all participants in the innovative learning process [28]. At the same time, using these mobile applications effectively contributes to better-integrating students with different needs. In particular, it helps reduce social isolation, develop social skills, and increase students' self-confidence [29].

The modern era of digitalization establishes separate rules for organizing education in higher education institutions, including inclusive education, the implementation of which (in terms of equal access to opportunities to acquire knowledge and practical skills) is a humanistic trend of our time. The study's results confirm that mobile technologies significantly impact organizing an inclusive educational process in higher education institutions. Digital mechanisms such as interactive applications or adaptive educational platforms increase the effectiveness and accessibility of learning for higher education students with special educational needs.

The proposed results indicate that using mobile applications in inclusive education contributes to forming a more flexible and personalized approach to learning. Adaptive methods implemented through mobile applications allow higher education students to work independently at their own pace and have open access to teaching materials and lecture materials at a time convenient for their work. Such a tool is essential for students with certain physical limitations or who need a unique environment for learning due to the need for additional time to master the educational material [30]. However, the effectiveness of digital technologies is debatable, especially when considering their long-term impact on the quality of education. In particular, some researchers have argued that interactive applications are practical for rapidly acquiring essential knowledge and skills. At the same time, a deep understanding of the educational material is achieved after some time [31, 32]. Other scholars argue that adaptive methods implemented using mobile platforms can be effective only under certain conditions [14, 33]. First, it is about strengthening basic theoretical knowledge and practical skills using traditional teaching methods [34].

The proposed results indicate that digital educational technologies based on the use of mobile devices actively contribute to the involvement of higher education students in the learning process. Interactive applications allow for various ways of interaction, including learning management systems (LMS), mobile technologies for communication, tools for creating and editing content, mobile technologies for distance learning, various game elements, etc. Such a pedagogical arsenal increases students' interest in learning, contributing to a deeper understanding of the educational material. This confirms the conclusions of scientists who state the importance of finding a balance: excessive use of digitalization (e.g., gamification) in education can reduce the seriousness of the perception of educational material, turning the educational process into entertainment (in the negative sense of the word) [35, 36]. The proposed results suggest that turning learning into entertainment, which leads to a lack of concentration, will require additional research, especially given the characteristics of inclusive education and the contingent of students who are much better motivated and more focused on achieving educational outcomes.

In addition, as demonstrated in the article, mobile technologies have proven effective in providing access to inclusive education for students living in remote regions with complex transport logistics. Given this aspect, they need more access to traditional forms of education. Given the positive experience of using mobile devices,

such students could join educational programs regardless of their location, significantly increasing the opportunities for obtaining quality education [37]. The researchers also note that not all students have sufficiently equal access to the use of modern digital technologies (and, accordingly, mobile devices) and have satisfactory performance in terms of the stability of the Internet connection, which already creates additional obstacles to learning, creating separate barriers for groups of students, especially those from low-income backgrounds [38]. Given the existing experience, this problem is relevant for inclusive education. However, in the current context, it requires an individual solution rather than comprehensive action at the state or regional level.

Therefore, the results generally confirm other scholars' findings that using mobile technologies is an effective tool for improving the quality of inclusive education. This approach allows for flexibility, accessibility, and personalization of the educational process [39-40]. Such elements enhance the formation of an effective, inclusive educational environment and ensure the regulation of equality in access to education (subject to specific requirements). At the same time, overcoming certain risks is still being discussed in the scientific literature, which will require further scientific generalizations.

The proposed study is based on a methodology that has certain limitations. First, we took into account English-language relevant studies published mainly in the last ten years. This approach was intended to provide a comprehensive overview of the problem using the most up-to-date research. On the other hand, the issue of inclusive education has been studied for a long time, so some essential opinions may chronologically go beyond the proposed study's scope, creating preconditions for further in-depth analysis of this issue.

5. Conclusions

Thus, to support inclusion in the modern higher education space, it is worth using various technologies, both traditional and unique. The paper establishes that traditional technologies to support inclusion include applications for organizing learning (e-textbooks, platforms for distance courses, electronic video conferencing, LMS), mobile technologies for communication (special messengers and chats), applications for creating unique learning content, including use of multimedia, virtual technologies, and simulations. Special tools for inclusive learning include apps that help improve vision and hearing. In addition, it includes mobile applications that support lectures with various subtitles. At the same time, students with dyslexia and other reading/writing problems should be supported by mobile apps that help correct spelling or grammar and contain audiobooks specifically adapted for dyslexic students. The study found that such mobile technologies improve knowledge acquisition and make learning more efficient. In addition, these applications contribute to the greater integration of students, reduce social isolation, develop social skills, and increase self-confidence. Thus, inclusion positively impacts both the individual development of students and the overall atmosphere in the educational environment.

Declaration of competing interest

The authors declare that they have no any known financial or non-financial competing interests in any material discussed in this paper.

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