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The use of modern digital technologies in the training of future music teachers

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Abstract

Relevance. The research relevance is determined by the fact that modern society is rapidly integrating digital technologies into various spheres of life, including education, which creates the urgency and need to understand how these digital technologies can be best used in the educational process.

Purpose. The purpose of this study is to examine and analyse the impact of modern digital technologies on the learning process of future teachers of music education.

Methodology. In this paper, an analytical method, generalisation, and systematisation were used.

Results. As a result of the investigation of the introduction of digital technologies into the training of future music teachers, a positive effect on learners was found, making the training more attractive and stimulating them to engage in independent research in the field of music. Teachers have also become more open to using modern tools and resources in their work, realising that technology enriches the educational process and makes it more efficient and satisfying for students.

Conclusions. The study established that digital instruments such as “Smart Piano”, “Yousician”, and “Auralbook” effectively attract students’ interest and develop their skills in music education. However, it is important to note that cooperation with experienced teachers remains an integral part of the educational process, contributing to shaping

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competent music teachers. The results of this study can be useful for teachers to better understand how to integrate digital technologies into the learning process and improve learning efficiency.

Keywords: musical instruments; art; education; online applications; music teacher.

Introduction

The younger generation has grown up in the digital era, making the use of modern technologies essential in enhancing music education, rendering it more engaging and interesting for students.

Digital tools allow for a broader range of educational opportunities, including access to global musical content, feedback mechanisms, and interactive learning platforms. It is crucial for future music teachers to be prepared to utilise modern technologies in their work to better equip students for the musical challenges of the contemporary world.

Therefore, the effective incorporation of digital technologies in education necessitates comprehensive research to identify best practices, understand their impact on student learning and motivation, and develop new teaching methods. The lack of preparation and experience among teachers in using digital tools and programs can pose a barrier to the successful integration of technologies into the learning process, which is the focus of this study.

A. Haleem et al. [1] emphasise the pivotal role of digital technologies in creating an educational environment that promotes inclusivity. According to researchers, digital technologies have significantly influenced the field of education, becoming even more relevant in the modern world.

These technologies have transformed from simple information providers into co-creators, mentors, and evaluators of the learning process. Researchers highlight that these factors stimulate interest in learning and research, necessitating in-depth exploration of the integration of digital technologies into education, particularly in training future music teachers.

L.V. Dobrovolskaya and K.G. Akhmetova [2] assert that the implementation of information and communication technologies (ICT) in the musical educational process has several important aspects, including educational and motivational dimensions. Researchers note that among the substantive aspects, there are opportunities to create a test database, musical trainers, and interactive homework assignments. Access to additional information, such as details about composers, performers, and musical instruments, is often needed in music education.

The use of ICT enables the efficient utilisation of electronic resources for lesson preparation and for monitoring and assessing students' knowledge. In addition, these technologies contribute to the development of information literacy skills and the use of new technical tools for information search and processing. Therefore, it is essential to explore the aspects of using digital technologies in the education of future music teachers [3].

S.A. Intykbaev [4] underscores the integral role of contemporary digital tools in music education. He urges music teachers to thoughtfully incorporate modern technologies, considering the rich potential they offer. According to him, modern synthesisers and computer

programmes for music creation and arrangement can be powerful tools in preparing future music teachers.

The researcher notes that modern teaching tools allow exploring musical concepts more deeply, creating new sound textures and musical compositions, and developing interactive lessons and training materials. Such an approach can significantly enrich the educational experience of future music teachers and strengthen their competencies in the field of digital music pedagogy. Therefore, it is essential to devote more attention to studying this aspect in the preparation of future teachers of musical arts.

Researchers T.I. Kotova and E.I. Sakova [5] emphasise the importance of the interaction between education and digital transformation, highlighting the modern challenges faced by the pedagogical field. They state that contemporary pedagogical education must be re-evaluated and adapted to new realities.

Based on their analysis, the researchers assert that modern pedagogical issues in the era of digital transformation are linked to the integration of digital technologies into the educational process and the development of new teaching methods that promote the digital literacy of students and teachers. It is essential to explore the potential of digital transformation in the education of future teachers, especially in the field of music education.

A. Maba [6] underscores the importance of integrating digital tools and technologies into music education and the need to update educational methods in the modern world. According to the researcher, in a globalised society where information technologies play a pivotal role in all aspects of life, education cannot remain detached from this process.

The scholar is convinced that implementing innovative teaching methods, including computer technologies and software applications, opens new possibilities for students, particularly in music education, which deserves more in-depth study.

The purpose of this study is to examine and analyse the impact of modern digital technologies on the learning process of students preparing to become music teachers.

Materials and Methods

The study utilised methods of analysis, generalisation, and systematisation, enabling a thorough examination of the application of modern digital technologies in the education of future music teachers.

The application of the analytical method in this study allowed researchers to conduct a deeper and more meticulous analysis of the integration of digital technologies into the educational process of future music teachers. This methodological approach expanded the understanding of this research area. Through the analytical method, existing problems and challenges faced by future music teachers in implementing digital technologies were identified.

Using the analytical method, significant achievements and innovative practices in the use of digital resources and tools in music education, particularly digital applications such as “Smart Piano,” “Yousician,” and “Auralbook,” were highlighted. The analytical method facilitated the identification of factors that positively influence the development of the creative thinking of future music teachers. This method enabled the systematisation and organisation of information, making it more accessible and convenient for comprehension, thereby contributing to a more comprehensive understanding of the research subject and the formulation of balanced conclusions.

The generalisation method used in the study enabled the creation of a comprehensive picture of the current state of the digital sphere in modern music education. This allowed for the identification of common trends and patterns and the recognition of important aspects that should be considered when integrating digital technologies into the educational process. This method enabled a systematic analysis and synthesis of data related to the development of the creative potential in the education of music teachers.

The generalisation method allowed the identification of effective strategies and methodologies that promote the development of creative thinking in the context of music education, which includes active learning methods, practical application of knowledge, and modern pedagogical approaches. This research method helped explore aspects of the educational and professional activities of future music teachers that require the use of digital technologies.

These aspects include the development of educational materials and resources, teaching theoretical foundations of music, practical training on musical instruments, analysis and evaluation of educational outcomes, working with a virtual audience, and individualisation of education. Thus, the method of generalisation allowed for a deeper exploration and understanding of various aspects of developing the creative abilities of future music teachers, which is crucial for further refining educational programs and practices in this field.

Systematisation organised information and conclusions into a logical and structured form, contributing to a clearer understanding of which aspects of music education most effectively impact students’ performance and motivation. Using the method of systematisation, the aspects of modern education in the Republic of Kazakhstan, features and problems of the introduction of digital technologies for the training of future teachers of musical art were investigated. The data systematisation method strengthened the methodological basis of the study and made it more holistic.

Results

The field of education has undergone significant impacts from digital technologies. These technologies not only change teaching methods and educational practices but also deeply influence the structures and possibilities of schools during the process of digital transformation. This process is not limited to simply implementing technological tools in the educational environment; it also affects educational methodologies and managerial aspects of education.

Digital technologies open new horizons for education, providing students and teachers with numerous tools for more effective learning and enriching educational experiences. They facilitate more flexible forms of learning, allowing students to study materials outside of school, engage in distance learning, and personalise the educational process according to individual needs [7].

The COVID-19 pandemic further emphasised the importance of digital technologies in education, as they became an integral part of the learning process and provided opportunities for remote learning amid restrictions on in-person attendance in schools. It is important to note that digital technologies have reshaped the paradigm of education, making it more interactive and accessible [8; 9].

The modern education system is inseparable from the use of digital technologies. Digital classrooms represent a significant breakthrough in the design of modern learning spaces. Education and technology are interrelated and should interact since the development of education is inextricably linked with the evolution of technology [10; 11].

The introduction of digital technologies into the learning process allows optimising learning, making it more productive and interactive. In addition, in the modern world, students need to master various technical skills, which makes it important to introduce digital technologies into curricula [12; 13].

Teachers, in turn, must constantly improve their competencies in digital technologies to meet modern educational requirements, including future teachers of musical art. To achieve a successful digital transformation in the field of education, it is necessary to consider many factors that interact and influence the change process. Important aspects to consider are:

1. One of the primary factors is the availability of the necessary infrastructure, including high-speed Internet, hardware, and software. This ensures the availability of technology for students and teachers.
2. Effective use of digital technologies requires teachers’ skills and competencies. Professional training and development of teachers in digital skills and teaching methods using technology is an integral part of a successful digital transformation.
3. Effective management of educational institutions plays a key role in successful digital transformation. There is a need for clear strategies, plans, and policies that promote the integration of digital innovations into the educational process and ensure sustainability and long-term development.
4. With the increasing use of digital technologies in education, it becomes critically important to ensure the protection of students’ and teachers’ data. Strict security measures, data processing, and storage policies are required.
5. Successful digital transformation requires the involvement of all participants in the educational process, including students, parents, and educational workers. Their active participation and feedback can improve the process of modernisation and adaptation.

Considering these factors, educational institutions can more effectively implement digital transformation,

providing modern and high-quality education for students [14].

Digital technologies have become an integral part of education and musical creativity. With the use of modern digital tools and platforms, students and teachers receive new opportunities for the development of musical creativity and learning. Leaders of educational institutions play a crucial role in creating conditions for the successful integration of digital technologies into the learning process and stimulating students' musical creativity.

Considerable importance lies in supporting educators in mastering digital tools and creating a space where they can experiment and develop musical ideas using technology. Digital technologies provide broad opportunities for innovation and creativity in music education, and educational leaders can play a key role in their successful implementation [15].

Modern education in the Republic of Kazakhstan is undergoing radical changes, actively incorporating innovative teaching methods. These methods are designed to stimulate students' independent development of functional literacy, active acquisition of knowledge, and the development of communication skills with peers.

Today, a music teacher has become a kind of universal educator, with many tasks in the classroom, including developing musical literacy, listening skills, rhythmic training, studying musical works and their authors, building a song repertoire, and analysing musical expressiveness.

The music teacher plays a vital role in developing students' skills in culturally perceiving and understanding music. These abilities and skills encompass both emotional and rational aspects of thinking, aiming for students to comprehend music with both their minds and hearts.

In general education schools, music teachers work on developing these skills through the analysis of instrumental pieces. To engage students' interests, teachers create an emotional atmosphere during lessons, encouraging their desire to explore new things and overcome challenges.

Music pedagogical activities encompass various aspects, including pedagogical, choral conducting, musicological, musical-performance, and research components. This requires music teachers to independently generalise and systematise the knowledge they acquire. Artistic activities are essential as a part of this creativity [16; 17].

The modern training of future music teachers in Kazakhstan faces a set of contemporary challenges that require active and innovative solutions. One of the key aspects is the necessity to adapt the educational process to rapidly changing realities and the needs of modern education.

Presently, music education must involve the use of modern technologies and digital resources, making the learning process more engaging and effective for students by actively involving them in the educational process. It is crucial for future teachers of musical arts to adapt to new technologies and incorporate modern pedagogical methods and research [18; 19].

Consequently, the preparation of future music teachers in Kazakhstan presents significant tasks and challenges today. However, it also offers extensive prospects for development, including the integration of modern technologies and the update of educational programmes.

Research and practice demonstrate that the formation and expansion of the creative abilities of future music teachers can be achieved through the comprehensive use of folk pedagogy methods (Figure 1).

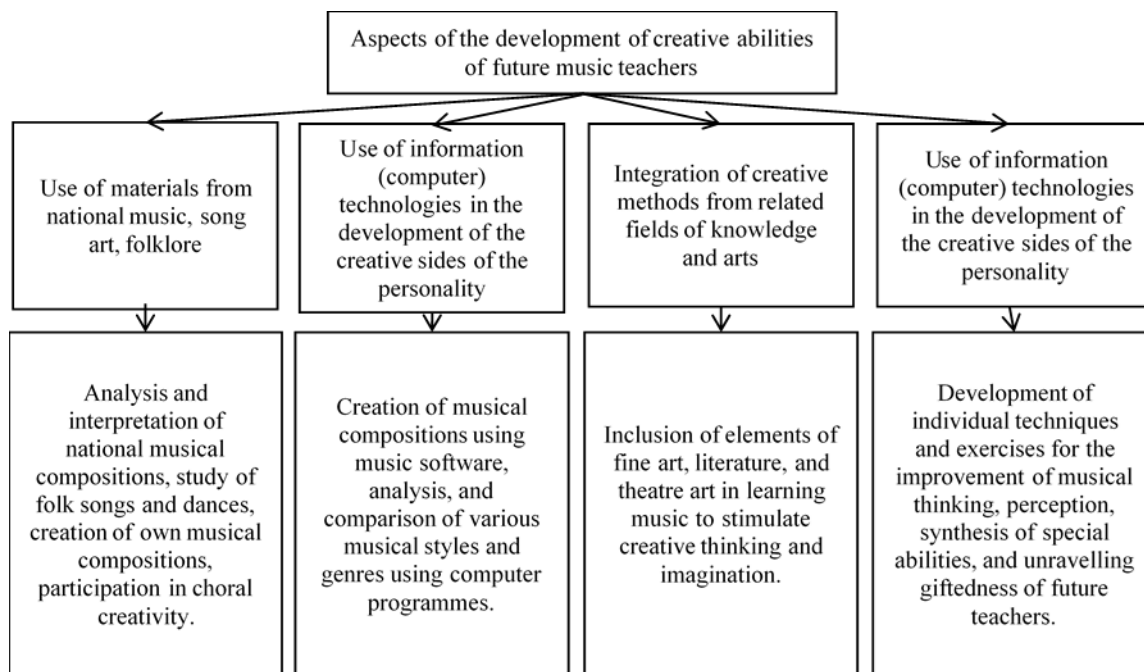


Figure 1. Aspects of the development of creative abilities of future teachers of musical art in Kazakhstan

The development of creative abilities among future music teachers is of utmost importance in the modern

educational landscape. This development is realised through their creative music and pedagogical activities.

R. Sydykova et al. [21] emphasise the significant role of developing music teachers' creative thinking and fostering their ability to work creatively to achieve meaningful results. This development is primarily directed towards shaping the student as an individual and enhancing their musical education.

Therefore, adapting pedagogical practices, the ability to adapt to new approaches and products, and deviating from traditional modes of thinking and teaching methods represent the teacher's adaptation to the changing educational environment. The use of online applications in pedagogical activities demonstrates their competence in this regard.

This comprehensive approach effectively develops the creative skills of future music teachers, preparing them for high-quality teaching of this art in contemporary settings. This is particularly crucial within the context of integrating digital technologies into the educational process.

Today, music teachers largely possess professional skills in using modern music technologies. Nevertheless, they still face a number of problems with the full transition to technology-based classes. Possible barriers include limited instructional time, lack of relevant programmes in curricula, financial constraints, and restricted access to modern technical resources. This highlights the importance of preparing future music teachers to use advanced music technologies within the educational process and the need to overcome obstacles that may arise during the integration of these technologies into educational programmes.

Ensuring students' access to appropriate resources and training is essential for future music educators to successfully integrate technologies into their teaching practices and enrich the learning experience for their students [22; 23].

The role of teachers has undergone significant changes in the 21st century as conventional teaching methods have given way to more student-centric approaches. Teachers are no longer limited to being a "source of information" who convey their knowledge to the students.

Teachers have become mentors and guide students to independent access to information and manage the learning process, ensuring its quality and development.

Today, teachers should be active participants in the introduction of technology into the educational process. This means that the teacher needs to monitor the development of technologies in their field and be able to use them in the classroom, integrating them into the learning process. This is an integral part of modern education.

"Smart Piano" is an example of the use of artificial intelligence in combination with wireless networks [24]. Artificial intelligence, as a technology, is able to analyse and evaluate piano playing in real-time. This allows the teacher to obtain accurate data on the student's performance, including nuances in technique, dynamics, and pace. Such an analysis can be useful for identifying mistakes and improving the student's skill.

Wireless networks, in turn, allow teachers and students to be located at a distance from each other, significantly expanding the geographical possibilities of learning. This provides students access to the expertise of teachers that might be otherwise inaccessible without the use of networks. Such cooperation between the teacher and

technological gadgets enriches music learning, making it more accessible, effective, and interactive.

Importantly, the paper underscores the significance of combining the teacher's musical expertise with the analytical capabilities of artificial intelligence and the flexibility of wireless networks. This is an example of how technology can enrich and improve educational processes in the music field.

Furthermore, the application "Yousician" provides students with the opportunity to develop piano and guitar playing skills through specially structured lessons based on different difficulty levels. It allows students to practice, learn new material, and even adjust the learning pace according to their skill level [25].

Therefore, the modern teacher must not only be an expert in their field but also an integrator of technologies, capable of adapting to changes and providing maximum benefit for their students. Another example of an online application that changes music education is "Auralbook" [26].

This application replaces the teacher in the process of vocal training and is based on various exercises that help warm up the vocal cords and strengthen the voice. These exercises not only improve singing technique but also contribute to the development of aural skills.

Thus, "Auralbook" serves as an example of a technological tool that genuinely changes the way vocal training is conducted, making music education more accessible and effective for everyone interested in developing their vocal skills.

Therefore, online programmes and applications geared toward music education provide students and musicians with unique opportunities to develop and enhance their musical abilities, marking just the beginning of a revolution in music education using modern technologies. To gain a more comprehensive understanding of the various aspects of this important professional activity, it is necessary to explore the diverse aspects of future music teachers' educational and professional activities (Table 1).

Table 1. Aspects of the educational and professional activities of future music teachers

| Aspects of the educational and professional activity of the future music teacher | Application of modern digital technologies |
|--|--|
| Development of educational materials and resources | Creation of interactive educational materials and multimedia resources for teaching music. Using online platforms and applications to access sheet music, audio and video materials. Development of virtual lessons and trainings. |
| Teaching the theoretical foundations of music | Use of applications and programmes for teaching music theory and reading sheet music. Virtual instruments for demonstrating and understanding musical concepts. |
| Practical training on | Virtual instruments and applications for practicing playing musical instruments. |

| | |
|--|--|
| musical instruments | Learning platforms with feedback for skill correction. |
| Analysis and evaluation of learning outcomes | Systems for assessing and recording student progress in electronic format. Possibility to conduct tests and assignments online. Data analytics to identify areas that require improvement. |
| Working with a virtual audience | Conducting online lessons and master classes for students. Using video conferencing platforms for interaction and feedback. |
| Individualisation of training | Adaptation of curricula and assignments depending on the needs of each student. Personalised educational applications and courses. |

Source: compiled by the authors.

It is important to develop the competencies of future music teachers to work in a modern digital environment. Modern technologies, such as computer programmes and online resources, can be valuable tools in educating young professionals. Moreover, the use of electronic resources in education can contribute to a deeper understanding of global musical culture and enrich the knowledge of future music teachers.

Discussion

Over the last decade, music education has undergone significant changes, largely due to the active integration of modern technologies. Research in this field confirms that this has led to several important changes and improvements in music education practices.

Primarily, technology has become an integral part of music pedagogy. Teachers are actively experimenting with various technological tools and applications to make music learning more interactive and exciting.

Electronic textbooks, online learning platforms, and music applications provide musicians and students access to extensive resources, allowing them to explore various music styles and genres, develop their skills, and be inspired by new sounds [27-29]. It is necessary to investigate opinions on the application of digital technologies in the educational process of future teachers of musical art.

L. Weisheng and H. Hui [30] assert that modern educators must enhance their teaching methods, create stimulating learning environments, teach students to think actively in diverse fields, and pay attention to the development of their interests.

Researchers also emphasise the importance of nurturing students within the framework of musical study, encouraging the development of their intellectual activity, and creating interactive classrooms where teachers and students can easily interact. In modern education, it is essential for teachers to establish close relationships with students, show interest in their opinions, and constantly improve their teaching methods. According to researchers, this interaction and joint effort contribute to the development of innovative abilities and lay a strong foundation for future growth.

Comparing the results of this study, it is necessary to agree that modern education of future music teachers requires constant development of personal characteristics and teaching students to use digital technologies to update

the educational process and adapt it to the requirements of the modern level of societal development.

N. Selwyn et al. [31] emphasise that in modern education, acts of automation based on digital technologies are becoming more and more obvious. These automated processes, according to scientists, include software, applications, systems, platforms, and digital devices that penetrate various fields of education.

Despite each specific automation seeming minor in individual cases and quickly becoming invisible, digital technologies, in the researchers' opinion, shape the future of education. In this context, compared with the results of this study, it is crucial to emphasise that the use of digital technologies in music education stands out as an essential aspect of the development of students' and educators' musical abilities and cultural perceptions. Both studies recognise that digital technologies play a vital role in the modern educational environment.

D. Calderon-Garrido et al. [32] draw attention to the fact that modern digital technologies have a significant impact on the field of education, including the training of future music teachers. Scientists note that music teachers actively utilise digital tools and successfully integrate them into the educational process, leading to more effective music education.

Research indicates that digital technologies can be powerful tools for enhancing teaching methods and stimulating students' interest in music. This opens new opportunities for broader access to music education and enriches the learning process with diverse interactive resources and tools.

Comparing these findings with this study, it is crucial to emphasise the importance of preparing future music teachers to effectively use digital technologies. This will contribute to the improvement of the quality of music education and align with the modern requirements of the educational process.

W. Wan [33] states that digital technologies have a significant impact on the field of music education. The researcher highlights that modern digital tools and resources profoundly influence music education among students in China.

The researcher states that digital technologies significantly enrich students' educational experience in music and provide access to a substantial amount of musical content. This allows for more interactive and effective ways of learning music, fostering the development of creative and musical skills.

Compared with the present study, it is essential to note the necessity of integrating digital technologies into educational programmes and teacher training. This integration enables educators to maximise the potential of these technologies in the learning process.

B. Yao and W. Li [34] draw attention to the important role of the teacher in modern music education. The researchers question the exclusive reliance on modern online educational technologies, as they believe that students cannot grasp music without direct teacher involvement. They also underscore that although modern technologies provide numerous tools and resources for music education, the role of the teacher remains incredibly important. Teachers, according to researchers, can provide context, guidance, and expert knowledge that is difficult or

impossible to obtain solely through online courses and resources.

It was noted that musical education often requires individual guidance and feedback, which teachers can provide. Today, according to researchers, music education is not only about access to information but also the ability to structure the learning process and develop musical skills, a point also confirmed in the results of this study. While modern digitals can be powerful tools in music education, they cannot completely replace the role of the teacher [35-37].

C. Liu et al. [38], D. Ydyrysbayev et al. [39] and L. Narikbayeva et al. [40] in their study, noted that new technologies have a diverse impact on music education from different points of view. In general, according to the researchers, constantly changing innovations in technology have radically transformed approaches in music pedagogy, including teaching methods, feedback mechanisms, and assessment approaches. Scholars are convinced that in the context of traditional music education, teachers often find it challenging to provide immediate feedback on practical lessons for each student after classes.

Therefore, students' opportunities to receive feedback from peers and compare their achievements with others are limited. By using computer and network technologies, as noted, students have the opportunity to compare their achievements with those of others and receive instant comments from peers through network communications. This provides them with more opportunities for in-depth analysis and self-reflection.

Comparing these findings with the results of this study, the research confirms that the integration of technologies into music education not only contributes to improved student performance but also enhances their attitude toward studying music, stimulates their interest in the subject, and activates their participation in musical activities.

Based on the analysis of the studies and comparing them with this study, it is crucial to note that the most significant outcome of integrating technology into music education is its positive impact on students' academic performance and motivation.

Modern teaching methods, supported by technology, contribute to deeper and more interactive learning. Students can receive instant feedback, compare their results with others, and explore musical concepts in an interactive format. This makes learning more engaging and

encourages students to conduct independent research and experiments in the world of music.

Conclusions

Modern technologies enrich the educational experience of future music teachers and enable students to learn more deeply and interactively. Future teachers have the opportunity to receive instant feedback to be able to compare their results with other researchers and are provided with more flexible forms of education. However, for the successful integration of technologies into the educational process, music teachers need appropriate training and access to education, as teachers must learn to use technology effectively in their teaching practice.

The analysis of the application of digital technologies in the training of future music teachers revealed that such use of digital progress has a positive impact on students, transforming learning, making it more attractive, and stimulating students' independent research and experimentation in the world of music. On the other hand, the study also disclosed a significant change in teachers' attitudes toward technology. They are increasingly open to using modern tools and resources in their work.

Teachers realise that technology not only enriches the educational process but also makes it more efficient and satisfying for students. Digital technologies for the educational process in the musical field, exemplified by "Smart Piano," "Yousician," and "Auralbook," demonstrate the effectiveness of using artificial intelligence and digital tools to increase students' interest and develop their skills. Thus, while digital tools can significantly enrich music education, collaboration with a qualified teacher remains integral to the development of well-rounded musicians and music educators.

This study highlighted the importance of integrating technology into music education. However, further development and practical research projects are necessary for a deeper understanding of this area and the development of more effective educational practices. Therefore, researchers should focus on investigating the impact of digital technologies on students' creative thinking and artistic abilities in music.

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Conflict of Interest

None.

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Використання сучасних цифрових технологій у підготовці майбутніх вчителів музики

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Анотація

Актуальність. Актуальність дослідження визначається тим, що сучасне суспільство швидко інтегрує цифрові технології в різні сфери життя, включаючи освіту, що створює актуальність і потребу у розумінні, як ці цифрові технології можуть бути найкраще використані в освітньому процесі.

Мета. Метою цього дослідження є дослідження та аналіз впливу сучасних цифрових технологій на процес навчання майбутніх вчителів музичного мистецтва.

Методологія. У цій статті використовувалися аналітичний метод, узагальнення та систематизація.

Результати. В результаті дослідження впровадження цифрових технологій у підготовку майбутніх вчителів музики було виявлено позитивний ефект на учнів, що робить навчання більш привабливим та стимулює їх займатися самостійним дослідженням у галузі музики. Вчителі також стали більш відкритими до використання сучасних інструментів та ресурсів у своїй роботі, реалізуючи, що технології збагачують освітній процес і роблять його більш ефективним і задовільним для учнів.

Висновки. Дослідження показало, що цифрові інструменти, такі як "Smart Piano", "Yousician" і "Auralbook", ефективно привертають інтерес учнів та розвивають їхні навички в музичній освіті. Однак важливо зауважити, що співпраця з досвідченими вчителями залишається невід'ємною частиною освітнього процесу, що сприяє формуванню компетентних вчителів музики. Результати цього дослідження можуть бути корисними для вчителів для кращого розуміння того, як інтегрувати цифрові технології в навчальний процес та покращити ефективність навчання.

Ключові слова: музичні інструменти; мистецтво; освіта; онлайн-додатки; вчитель музики.