

Digital Technologies in Music Education: The Case of Chinese Students



Weijia Wan

School of Music, Soochow University, Suzhou, China
weijiawan3@yahoo.com

Abstract: During the pandemic, the use of modern technologies in all spheres of education, in particular in music education, intensified, therefore, the study of their impact on indicators of students' motivation to study and the peculiarities of the formation of professional competencies is relevant. The study purpose is to analyse the digital technologies impact on the motivation of Chinese students and the development of their professional competencies in the study of music. The research methodology is based on the method of experiment and survey. The survey results show that the majority of respondents (55%) confirmed the use of traditional music education methods in their educational institutions; 66% of students reported that they use digital technologies in their studies while 34% noted that they do not use them in music education. Moreover, only 32% are highly competent in digital technologies, which indicates a lack of research on modern technologies in education, while 22% have an average level of competence and almost half (48%) have a low level of competence. The practical value of the results obtained is explained by the need to implement a training program involving the use of digital technologies in music education, which is evidenced by the low indicators of the development of technical competence (digital technologies) and a high level of students' motivation to master them. Prospects for further research are based on a comparative study of the features of the use of modern technologies in higher music education in other countries and the development of programs and courses to increase the level of students' motivation for learning based on digital technologies.

Keywords: creativity, critical thinking, digital technologies, lateral thinking, music education.

Resumo: Durante a pandemia, o uso de tecnologias modernas em todas as esferas da educação, em especial na educação musical, intensificou-se, portanto, é relevante o estudo de seu impacto nos indicadores de motivação dos alunos para estudar e nas peculiaridades da formação de competências profissionais. O objetivo do estudo é analisar o impacto das tecnologias digitais na motivação de estudantes chineses e no desenvolvimento de suas competências profissionais no estudo da música. A metodologia de pesquisa é baseada no método de experimento e levantamento. Os resultados da pesquisa mostram que a maioria dos entrevistados (55%) confirmou o uso de métodos tradicionais de educação musical em suas instituições de ensino; 66% dos alunos relataram que usam tecnologias digitais em seus estudos enquanto 34% notaram que não as utilizam na educação musical. Além disso, apenas 32% são altamente competentes em tecnologias digitais, o que indica falta de pesquisas sobre tecnologias modernas na educação, enquanto 22% possuem nível médio de competência e quase metade (48%) tem baixo nível de competência. O valor prático dos resultados obtidos é explicado pela necessidade de implementar um programa de formação envolvendo o uso de tecnologias digitais na educação musical, o que é evidenciado pelos baixos indicadores de desenvolvimento de competência técnica (tecnologias digitais) e um alto nível de alunos ' motivação para dominá-los. As perspectivas de novas pesquisas se baseiam em um estudo comparativo das características do uso de tecnologias modernas no ensino superior de música em outros países e no desenvolvimento de programas e cursos para aumentar o nível de motivação dos alunos para a aprendizagem baseada em tecnologias digitais.

Palavras-chave: criatividade, pensamento crítico, tecnologias digitais, pensamento lateral, educação musical.

Submetido em: 4 de novembro de 2021

Aceito em: 15 de maio de 2022

Introduction

Technical progress affects education and promotes active implementation of modern technologies (HASHIM, 2018). During the pandemic, all spheres of education switched to distance learning, which required knowledge of programs, mobile applications and online learning platforms for conducting classes (TING et al., 2020; VARGO et al., 2021). Moreover, approaches to learning have changed – today learning is student-centered and focused on practice (BELLINI et al., 2021). The use of digital technologies contributes to the development of professional competencies (technical competence (digital technologies), creativity, lateral thinking, communicative competence, strategic thinking) and mastery of technical skills for their effective application in training; in addition, strategic thinking competencies are developed (GORGORETTI, 2019).

Music education is developing in accordance with new requirements while modern technologies are being actively introduced in the form of mobile applications (Yousician, Vanido, Piano Academy, etc.), online learning platforms (Solfeq.io, Google Classroom, Flat.io, etc.), and video conferencing software (Zoom, Googlemeet, Skype, etc.) (CALDERÓN-GARRIDO et al., 2020). The active introduction of innovations into the system of music education expands the opportunities for practical activities and the learning process as a whole becomes more diverse, which increases the level of student motivation (CREMATA and POWELL, 2017). The widespread implementation of individual and student-centered learning approaches contributes to the free use of new teaching methods and modern technologies of various types (online learning platforms, mobile applications, online courses, video and audio recordings, etc.) (WADDELL and WILLIAMON, 2019). In the field of music, the key skills are creativity and lateral thinking, which, along with other competencies, make it possible to increase the level of general professional development of a rising musician (T. BELL and J. BELL, 2018). Lateral thinking promotes creativity, which is realized through creating one's own music in the

learning process (SRIKONGCHAN et al., 2021). Creativity and lateral thinking are formed under the influence of the use of interactive technologies, as they provide an opportunity to visualize theoretical material, contribute to students' own creativity (writing melodies or lyrics). Thus, modern technologies open up opportunities for music training due to their highly functional capabilities (BAUER and MITO, 2017).

The use of Facebook, Twitter, Instagram and WhatsApp applications is effective in music training; these are most often used for the purpose of communication and exchange of information or audio recordings (DESMURS, 2021). For example, WhatsApp allows users to create group chats and share songs, which improves not only professional musical skills, but also communication and teamwork skills (VENTURA, 2017).

During the pandemic, the approach to teaching music also changed. There are examples of the use of modern technologies in a blended learning environment in music education; at the same time, this method is similar to the flipped classroom method when theoretical content is studied independently and practice occurs in the classroom (CRAWFORD, 2017). The flipped classroom allows students studying music to prepare at home for lessons with musical instruments, as well as to demonstrate their skills during online classes (NG et al., 2022). Thus, the use of the flipped classroom method allows students not only to study theory, but to spend more time practicing practical skills.

The purpose of the study is to analyze the impact of digital technologies on the motivation of Chinese students and the development of their professional competencies in the process of studying music. The research objectives are to track the use of digital technologies in music education at the university under study; to identify and analyze the level of students' motivation for learning and the features of the development of professional competencies based on the survey; to develop a program based on digital technologies in order to increase the level of motivation and technical skills of students to improve the indicators of their

professional competencies. China was chosen as the object of research, as China is rapidly developing its technical field and creating new technologies that can be used in education. In addition, China's music education is at a high level of development, including through the active use of modern technology. In general, in Chinese education, modern technologies are used to increase the professional competencies of students, as well as to expand methodological approaches to learning, while creating conditions for improving the technical competence of teachers (MINJIE, 2021). In addition, Chinese education is actively using artificial intelligence, virtual reality, robotics, online educational platforms, electronic dictionaries, etc. (ZHU, 2013).

Literature Review

The processes of informatization and the rapid development of technologies contribute to the formation of new educational approaches aimed at developing technical competence and skills of logical, strategic, and lateral thinking, as well as imagination and creativity in education, in particular in music training (CAMLIN and LISBOA, 2021). Modern technologies make it possible to produce new ideas, create non-standard melodies and lyrics, creatively use musical elements and devices which indicates the process of developing creativity (KOKOTSAKI and NEWTON, 2015). Critical and lateral thinking skills include the ability of students to develop their own creativity, write melodies and lyrics, as well as improvise during their performance, rather than using ready-made components of musical creativity (CHANG and ZHOU, 2022).

The pandemic has shown the inefficiency of the traditional education system characterized by the outdated methods of studying and reviewing theoretical material, lack of practice and approaches aimed at the development of competencies (QULMATOVA et al., 2021). The traditional education system involves the study of theoretical material, its mechanical reproduction,

insufficient practice. Traditional education differs from modern methods by the lack of modern interactive technologies in the educational process. Modern technologies give the opportunity to prepare and conduct classes, visualize theoretical material, listen to audio recordings and watch videos (CALDERÓN-GARRIDO et al., 2020). During and after the pandemic, there was an active search for the most effective training methods, in particular those based on modern technologies (mobile applications (Yousician, Vanido, Piano Academy, etc.), online learning platforms (Solfege.io, Google Classroom, Flat.io, etc.), and video conferencing software (Zoom, Googlemeet, Skype, etc.)) (DANIEL, 2020). The effectiveness of modern technologies in music education is explained by the focus on practical activities and the development of professional skills and competencies required for students-future musicians. In music education, modern technologies can be used at all stages of learning activities, in particular in preparation for classes, writing melodies and lyrics, performing musical material with musical instruments, etc. Accordingly, researchers are considering the possibilities of using digital technologies in music education.

An example is an experiment conducted in Singapore, which showed that video-based learning contributes to the development of cognitive abilities through the activation of all cognitive processes – imagination, perception, thinking, reproduction, fantasy, etc. (CHUA and TAN, 2021). Also, in Saudi Arabia, the possibilities of using augmented reality technology in music education were explored, and a program was developed to prepare teachers and students for this (ALSADOON and ALHUSSAIN, 2019).

Researchers from Aalborg University Copenhagen (Denmark) have suggested the use of virtual and augmented reality technologies in music education (SERAFIN et al., 2017). One of the advantages of modern technologies in music education is the possibility of visualization through special software or an interactive whiteboard (BAKER et al., 2019).

In England, an integral approach to teaching music has been implemented in higher education; the students were divided into

small groups according to a musical instrument they played, which made it possible to simultaneously apply the studied material in practice and develop communicative competencies (GIBSON, 2021). The advantages of this approach are manifested in the course of its application; it is practice-oriented, which allows students not only to exchange the experience they acquired but also provides them with the opportunity to apply the methods of reflective dialogue, creativity, and strategic thinking through solving situations in the process of communication and playing a musical instrument (SVALINA and SUKOP, 2021).

In addition, Spanish scholars have investigated the effectiveness of modern technology in music education to improve the academic performance of students (ARÓSTEGUI, 2020). According to the results of the experiment conducted after training with the use of digital technologies, mainly mobile applications and online learning platforms, the majority of students (75%) managed to improve their academic performance and achieved intermediate and high levels.

Belgian researchers have developed a digital educational technology that combines interactive visual technologies and audio software – Music Paint Machine; it is characterized by the use of music education approaches involving interactive technologies (TING et al., 2020). This educational technology is based on the link between innovative and traditional methodologies while relying on the creative use of visualization to support instrumental music teaching and learning.

Methods and Materials

Research Design and Sample

To determine the degree of use and effectiveness of digital technologies in music education and the level of professional competencies of students, a study based on a survey of respondents was carried out. The methodology is based on experimental and

survey methods. This methodological approach made it possible to identify the initial level in order to develop a training program to improve professional competencies and motivation of students.

The study was conducted at the University of China. The experiment involved 596 students studying music. The research was carried out from April to May 2021. The main selection criteria were the year of study and the specialty of students; age or gender characteristics were not considered. Students of other specialties were not allowed to participate in the survey (Table 1). The study involved first-year students. This selection criterion is explained by the aim to analyze the effectiveness of digital technologies for students who have just started studying music. Senior students were not involved in the experiment as they could have already used various technologies in the learning process.

Table 1 - Research sample.

INDICATOR	THE UNIVERSITY OF CHINA	
NUMBER	596	100%
YEAR OF STUDY	1	100%
AGE	17	35%
	18	65%
SPECIALTY	MUSIC	100%

Survey

The study consisted of two stages. At the first stage, testing was carried out in order to determine the initial level of digital technology development, as well as the level of motivation and professional competencies of students. First, a Google form questionnaire was developed. The form included the following questions: "Which methods (modern or traditional) are preferred in your educational institution?", "Do you use digital technologies in music education?", "What is your level of professional competence in digital

technologies (high, average, low, not competent at all)?”, “What professional competencies do you think are important in music education?”, “What is the level of your motivation for mastering the use of modern digital technologies in music education: very high, high, average, below average, low?” The questionnaire with instructions for taking the test was emailed to students. There was no time limit to complete it.

At the second stage, a music training program with the use of digital technologies was developed. The program aimed to improve the digital skills of students, increase their motivation to study music, and develop professional competencies (technical competence (digital technologies), creativity, lateral thinking, communicative competence, strategic thinking). To achieve the goal such modern technologies as computer whiteboard; desktop computers and laptops; projectors; distance learning; mobile applications; online platforms; artificial intelligence; virtual reality has been used. The program is based on one thematic module “Digital Technologies in Music Education” divided into separate classes with the use of modern technologies of various types and aimed at developing specific competencies and skills.

Statistical Processing

The responses of respondents were processed in Statistica and Microsoft Excel. Based on the results obtained, charts with the indicators separately for each question were formed.

Research Limitations

The limitations of the study are associated with a small sample size as the experiment involved only the University of China. Other universities located in different countries have not been studied.

Ethical Issues

The experiment was carried out in compliance with all ethical standards and anonymity; the participants were not required to provide confidential information (name, surname, age or place of residence, etc.). The respondents also gave their written consent for the conduct of the study and data processing. One of the requirements was to indicate the year of study at the time of the experiment. As the survey was carried out after training students on various online learning platforms, the students had to indicate the online platform they used. This factor was one of the key factors in the study of the effectiveness of online platforms in learning.

Results and Discussion

Figures 1-5 show the respondents' answers to the questions that make it possible to analyze the level of digital competence and motivation for the use of modern technologies in music education among students.

In the context of the methods (modern or traditional) used in the university under study, the majority of respondents reported the prevalence of traditional ones (55%), which indicates a low level of development of modern technologies. In turn, 45% of students noted modern methods (Figure 1).

Figure 1 - Responses to the question "Which methods (modern or traditional) are preferred in your educational institution?"

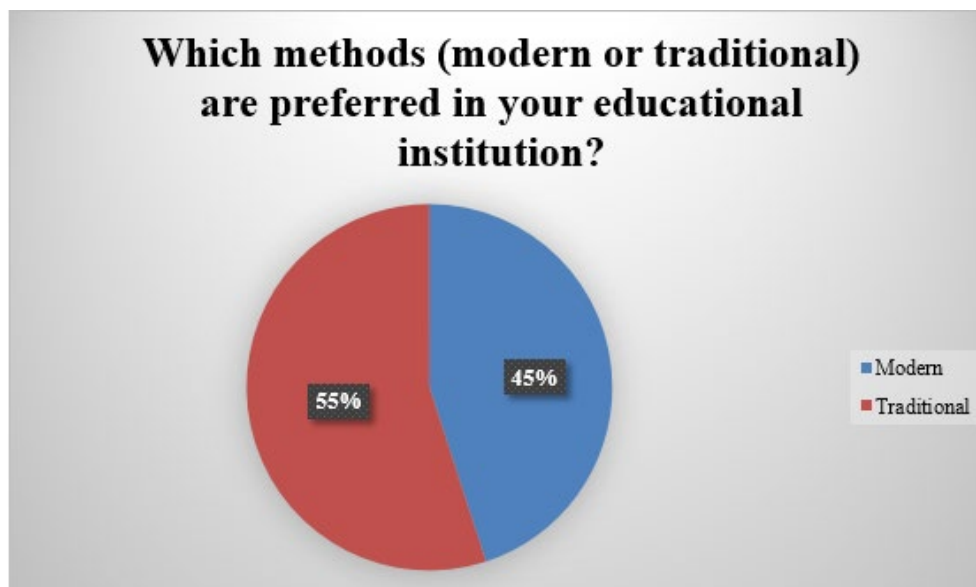


Figure 2 shows the respondents' answers to the question "Do you use digital technologies in music education?" Thus, 66% of students confirmed the use of digital technologies while 34% reported that they do not use them in music education.

Figure 2 - Responses to the question "Do you use digital technologies in music education?"

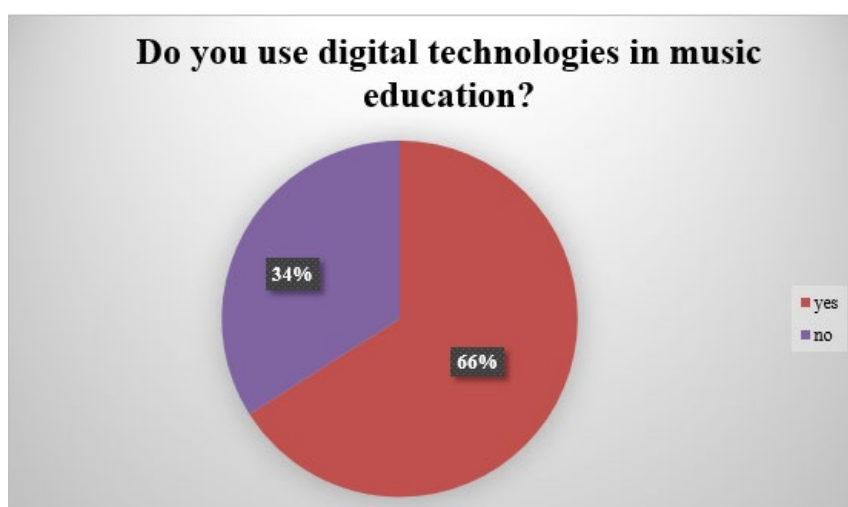


Figure 3 demonstrates the level of digital competence among students. At the same time, only 32% have a high level of digital skills, which indicates an insufficient study of modern technologies in teaching, while 22% have an average level and almost half (48%) have a low level. Also, a significant drawback is the fact that 8% do not have professional competence in digital technologies at all. This affects the quality of education, which in modern conditions requires the student to use technical skills in learning.

Figure 3 - Responses to the question "What is the level of your motivation for mastering the use of modern digital technologies in music education (very high, high, average, below average, low)?"

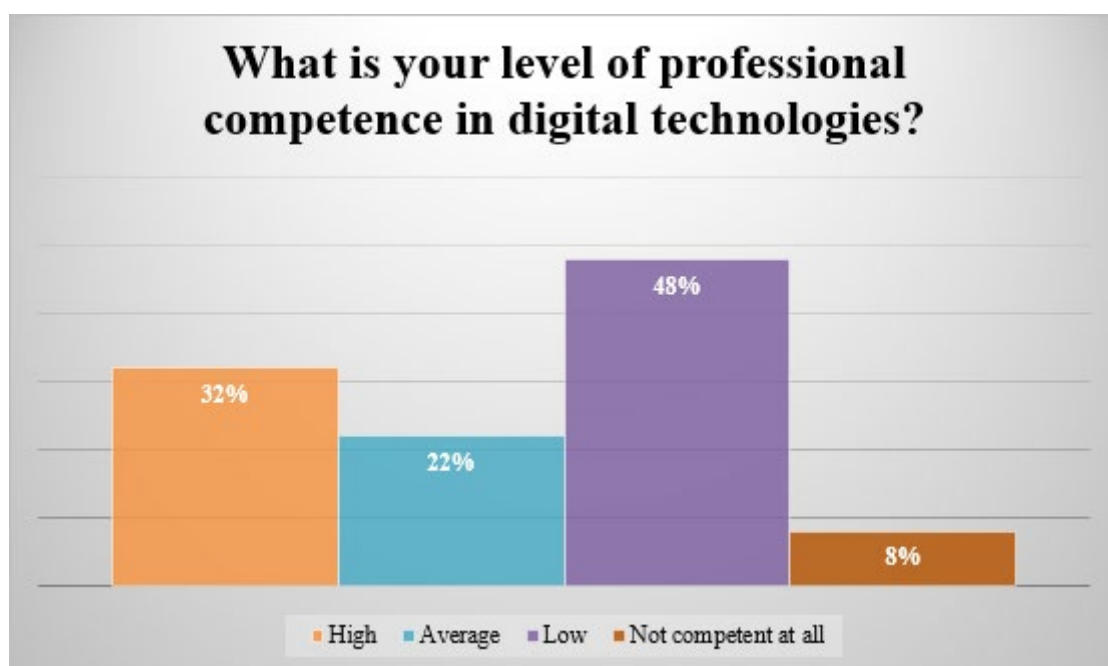
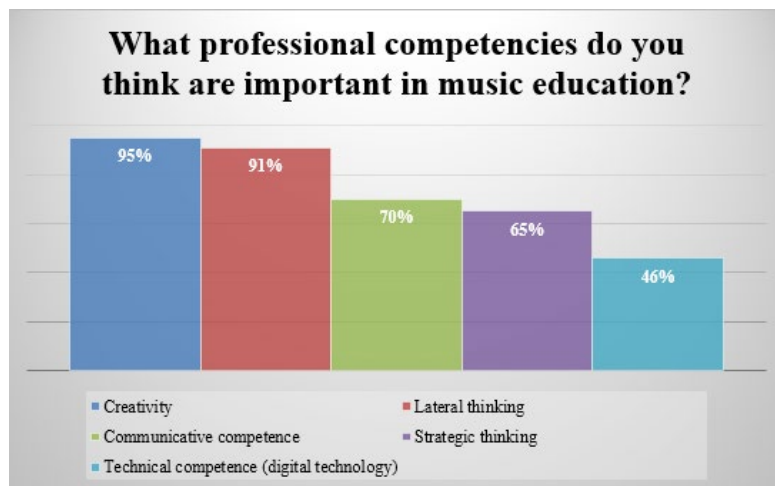


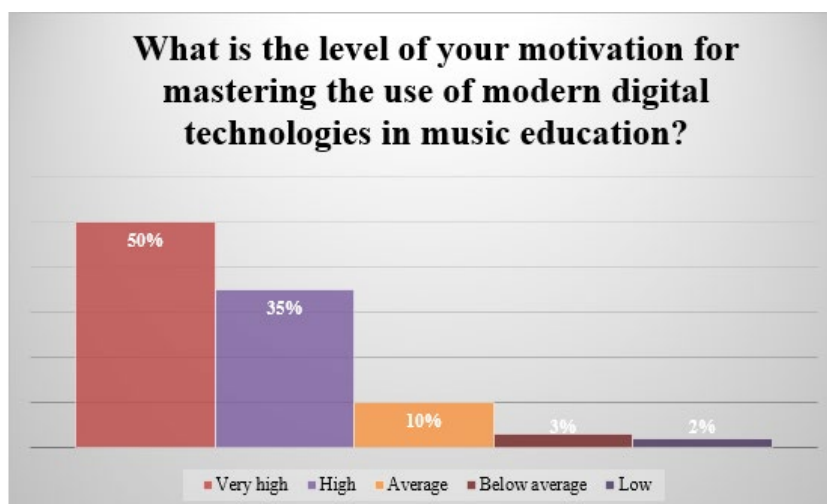
Figure 4 shows the professional competencies that the respondents believe are important in music education. The indicators of creativity (95%) and lateral thinking (91%), which are essential in the study and production of music, are the highest. Thus, communicative competence is characterized by the indicator of 70% and strategic thinking - 65%. However, technical competence (digital technologies) has a relatively low percentage indicator (46%).

Figure 4 - Responses to the question “What professional competencies do you think are important in music education?”



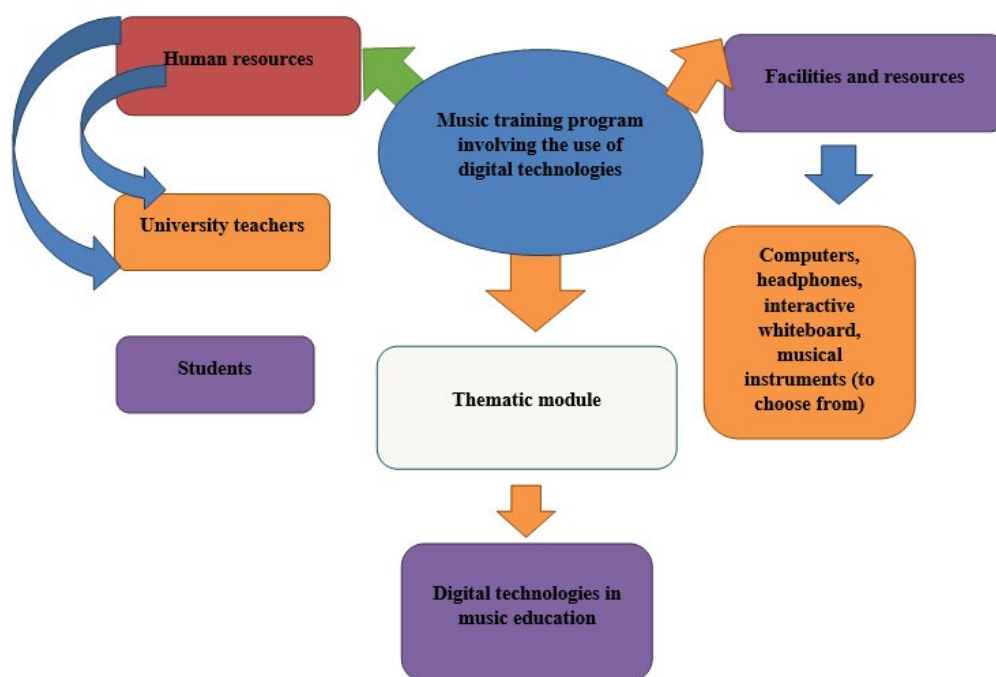
Based on the indicators of students' motivation to master the use of digital technologies in music education, five levels of respondents' motivation were determined (Figure 5). Half of the students (50%) have a very high level of motivation. Accordingly, 35% of students are characterized by a high level of motivation, 10% have an average level, 3% – below average and 2% – low.

Figure 5 - Responses to the question “What is the level of your motivation for mastering the use of modern digital technologies in music education: very high, high, average, below average, low?”



Thus, the results of the experiment demonstrate the need to develop a music training program in order to increase the motivation of students and develop their professional competencies (Figure 6).

Figure 6 - Structure of a music education program involving the use of digital technologies.



The training program consists of one thematic module “Digital Technologies in Music Education” divided into classes aimed at the introduction of digital technologies, the development of professional competencies, and increasing students’ motivation to switch to music training based on digital technologies (Table 2). The implementation of the program requires facilities and resources: computers for the teacher and all students, an interactive board, musical instruments (to choose from) and human resources – university teachers and students. All classes were held in special classrooms at the university under analysis; for the convenience of students, they were divided into several groups of 20-25 people. Thus, each class required 20-25 workplaces. The course duration was one month. The training program relied on the

materials introducing digital technologies and contributing to the development of professional competencies and skills of students, as well as increasing their motivation for the transition to musical training with the use of digital technologies. Also, the teachers familiarized students with the educational platforms containing various courses, such as MOOC and Treernity.

Table 2 - Content of the training program with the use of digital technologies.

Thematic module	Components	Tasks	Resources needed
Digital technologies in music education	Digital technologies: - computer whiteboard; - desktop computers and laptops; - projectors; - distance learning; - mobile applications; - online platforms; - artificial intelligence; - virtual reality	Formation of digital skills in the course of music training; Increasing students' motivation to learn; Development of technical competence (digital technology); logical, critical, lateral, and strategic thinking; imagination; fantasy	<ul style="list-style-type: none"> - Computers with Internet access; headphones; interactive whiteboard; musical instruments (to choose from) - Textbook "Music Education with Digital Technology" (FINNEY et al., 2010); - Training course «Evaluation and Research on music classroom teaching examples» on MOOC; - Training course "Audio Music Technology" on MOOC; - Training course "Demonstration teaching of music curriculum in primary school" on MOOC; - Textbook "Handbook of Research on Barriers for Teaching 21st-Century Competencies and the Impact of Digitalization" (DHIR, 2021); - Training course "Principles of artificial intelligence" on MOOC"; - Training course "Application of artificial intelligence in Education" on MOOC; - Training course "Innovative thinking" on MOOC; - Textbook with practical exercises "The Basics of Critical Thinking Workbook" (BAKER, 2015); - Training course "Artificial intelligence and information society" on MOOC.

The training program should be implemented in the educational process in order to improve the indicators of the survey, increase the motivation of students and develop their professional competencies. New technologies promote creativity, lateral thinking, communicative competence and other competencies, as they allow students not just to study theoretical material and perform ready-made musical works, but to visualize theory, activate students' cognitive abilities, which can use modern technologies to improvise and texts. After studying the program, students can improve the level of development of these professional skills and competencies, as it is based on modern technologies and aims to develop specific competencies, practice-oriented approach, teamwork and ability to communicate with the audience.

The experiment and the results obtained show that students are not well-informed about modern information and communication and interactive technologies, in particular those used in music education. This indicates the relevance of the issue in China and other countries. For example, a study conducted in Spain demonstrates the possibility of using digital technologies as a kind of mediator in the educational process in order to prepare and conduct classes, visualize theoretical material, listen to audio recordings and watch videos (CALDERÓN-GARRIDO et al., 2020). Another example is the development of online courses to motivate students to study music. One of such online courses was developed in Florida. This course increased student motivation by 15-18% (MUSICEDUCATION, 2021).

The results of similar studies show that students are not ready for the transition to learning based on digital technologies, which indicates a low level of technical competence. For example, in Saudi Arabia, there was a study that determined the level of teacher and student readiness to use augmented reality in the learning process. It turned out that teachers, having the knowledge needed and being positive about modern technologies, do not use this technology in the classroom; thus, they are not ready to introduce digital technologies into the educational process (ALSADOON and

ALHUSSAIN, 2019). Comparing these results with those obtained in this study, we can conclude that students have a higher level of motivation to use modern technologies in training compared to teachers. Familiarization with the possibilities of their effective use in the learning process through the implementation of the training program described in the study will contribute to the development of digital skills.

Digital technologies are actively developed and used in American and Finnish universities; they have an effective impact on student learning, performance and motivation as they make it possible to diversify the educational process through the use of various visualization tools (for example, an interactive whiteboard or audio and video recordings) and practical application of theoretical knowledge (RUISMÄKI and JUVONEN, 2009). However, as the experiment shows, digital technologies are not widely used in the context of music training in the Chinese university under study, which indicates the need to develop and implement programs aimed at the development of technical competence and digital skills.

Conclusions

The experiment and the analysis of the results obtained make it possible to conclude that all students of the university under consideration are not ready to study music with the use of digital technologies, which indicates the need to introduce modern technologies and pedagogical innovations into the curriculum and encourage their active use by teachers in the classroom. The survey results show that the majority of respondents (55%) confirmed the use of traditional music education methods in their educational institutions; 66% of students reported that they use digital technologies in their studies while 34% noted that they do not use them in music education. Moreover, only 32% are highly competent in digital technologies, which indicates a lack of

research on modern technologies in education, while 22% have an average level of competence and almost half (48%) have a low level of competence. Also, a significant disadvantage is the fact that 8% do not have professional competence in digital technologies at all. The indicators of creativity (95%) and lateral thinking (91%), which are essential in the study and production of music, are the highest. Thus, communicative competence is characterized by the indicator of 70% and strategic thinking - 65%. However, technical competence (digital technologies) has a relatively low percentage indicator (46%). Half of the students (50%) have a very high level of motivation for mastering modern digital technologies in music education. Therefore, 35% of students are characterized by a high level of motivation, 10% have an average level, 3% – below average and 2% – low. The developed music training program with the use of digital technologies will make it possible to increase the level of students' motivation for learning, expand the list of professional competencies and develop digital skills in the process of studying music. The practical value of the results obtained is explained by the need to implement a training program involving the use of digital technologies in music education, which is evidenced by the low indicators of the development of technical competence (digital technologies) and a high level of students' motivation to master them. Prospects for further research are based on a comparative study of the features of the use of modern technologies in higher music education in other countries and the development of programs and courses to increase the level of students' motivation for learning based on digital technologies.

References

ALSADOON, Hamadah; ALHUSSAIN, Thamer. Faculty at Saudi Electronic University attitudes toward using augmented reality in education. **Education and Information Technologies**, Cham, v. 24, n. 3, p. 1961-1972, 2019.

ARÓSTEGUI, Jose Luis. Implications of neoliberalism and knowledge economy for music education. **Music Education Research**, London, v. 22, n. 1, p. 42-53, 2020.

BAKER, David; FOMUKONG-BODEN, Ann; EDWARDS, Sian. 'Don't follow them, look at me!': Contemplating a haptic digital prototype to bridge the conductor and visually impaired performer. **Music Education Research**, London, v. 21, n. 3, p. 295-314, 2019.

BAKER, Michael. **The Basics of Critical Thinking Workbook**. North Bend, OR: The Critical Thinking Co., 2015. 152 p.

BAUER, William I.; MITO, Hiromichi. ICT in Music Education. In: KING, Andrew; HIMONIDES, Evangelos; RUTHMANN, S. Alex (Eds.). **The Routledge Companion to Music, Technology, and Education**. New York, NY: Routledge, 2017. p. 115-126.

BELL, Tim; BELL, Judith. Integrating Computational Thinking with a Music Education Context. **Integrating Computational Thinking with a Music Education Context**, Vilnius, v. 17, n. 2, p. 151-166, 2018.

BELLINI, Maria Irene; PENGEL, Liset; POTENA, Luciano; SEGANTINI, Luca. COVID-19 and education: restructuring after the pandemic. **Transplant International**, Chichester, v. 34, n. 2, p. 220-223, 2021.

CALDERÓN-GARRIDO, Diego; GUSTEMS-CARNICER, Josep; CARRERA, Xavier. Digital technologies in music subjects on primary teacher training degrees in Spain: Teachers' habits and profiles. **International Journal of Music Education**, London, v. 38, n. 4, p. 613-624, 2020.

CAMLIN, David A.; LISBOA, Tania. The digital 'turn' in music education. **Music Education Research**, London, v. 23, n. 2, p. 129-138, 2021.

CHANG, Zhenhua; ZHOU, Min. The influence of different music styles on Chinese students' lateral thinking skills. **Thinking Skills and Creativity**, Netherlands, v. 43, Art no. 100990, 2022. <https://doi.org/10.1016/j.tsc.2021.100990>

CHUA, Sew Ling; TAN, Leonard. Examining online video-based professional development for music teachers. **Music Education Research**, London, v. 23, n. 5, p. 580-593, 2021.

CRAWFORD, Renée. Rethinking teaching and learning pedagogy for education in the twenty-first century: blended learning in music education. **Music Education Research**, London, v. 19, n. 2, p. 195-213, 2017.

CREMATA, Radio; POWELL, Bryan. Online music collaboration project: Digitally mediated, deterritorialized music education. **International Journal of Music Education**, London, v. 35, n. 2, p. 302-315, 2017.

DANIEL, Sir John. Education and the COVID-19 pandemic. **Prospects**, Heidelberg, 49(1), 91-96, 2020.

DESMURS, Sandrine. **A new season for digital music education?** 2021. Available at <<https://sms.aec-music.eu/digitisation/a-new-season-for-digital-music-education/>>. Accessed on 20 Aug 2021.

DHIR, Harpreet Kaur. **Handbook of Research on Barriers for Teaching 21st-Century Competencies and the Impact of Digitalization**. Pennsylvania: IGI Global, 2021. 468 p.

FINNEY, John; BURNARD, Pamela; BRINDLEY, Sue; ADAMS, Anthony. **Music Education with Digital Technology**. London: Bloomsbury Publishing, 2010. 240 p.

GIBSON, Sarah-Jane. Shifting from offline to online collaborative music-making, teaching and learning: perceptions of Ethno artistic mentors. **Music Education Research**, London, v. 23, n. 2, p. 151-166, 2021.

GORGORETTI, Başak. The use of technology in music education in North Cyprus according to student music teachers. **South African Journal of Education**, Pretoria, 39(1), 1-10, 2019.

HASHIM, Harwati. Application of technology in the digital era education. **International Journal of Research in Counseling and Education**, Padang, v. 2, n. 1, p. 1-5, 2018.

KOKOTSAKI, Dimitra; NEWTON, Douglas P. Recognizing creativity in the music classroom. **International Journal of Music Education**, London, v. 3, n. 4, p. 491-508, 2015.

MINJIE, Gao. The impact of modern technology on Chinese education. In **Proceedings of the 2021 5th International Seminar on Education**,

Management and Social Sciences (ISEMSS 2021). Atlantis Press, 2021. p. 571-574.

MUSICEDUCATION. **How to engage students utilizing music education tools & Technology**, 2021. Available at <<https://musiceducation.arts.ufl.edu/resources/how-to-engage-students-through-music-education/>>. Accessed on 20 Aug 2021.

NG, Davy T. K.; NG, Ellen H. L.; CHU, Samuel K. W. Engaging students in creative music making with musical instrument application in an online flipped classroom. **Education and Information Technologies**, Cham, v, 27, p. 45-64, 2022.

QULMATOVA, Buoysha Abdulhamidovna; BURANOVA, Dilfuza Anvarovna; AZAMJONOV, Karamatillo Odiljon ugli. Integration of e-learning and traditional education in the educational process. **Scientific Bulletin of Namangan State University**, Uyci, v. 2, n. 2, p. 366-372, 2021.

RUISMÄKI, Heikki; JUVONEN, Antti. The new horizons for music technology in music education. In: **The Changing Face of Music Education. Music and Environment**, 2009. p. 98-104.

SERAFIN, Stefania; ADJORLU, Ali; NILSSON, Niels; THOMSEN, Lui; NORDAHL, Rolf. Considerations on the use of virtual and augmented reality technologies in music education. In: **2017 IEEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual & Augmented Reality (KELVAR)**. Piscataway, NJ: IEEE, 2017. p. 1-4.

SRIKONGCHAN, Wandee; KAEWKUEKOOL, Sittichai; MEJALEURN, Sophon. Backward instructional design based learning activities to developing students' creative thinking with lateral thinking technique. **International Journal of Instruction**, Odunpazarı/Eskişehir, v. 14, n. 2, p. 233-252, 2021.

SVALINA, Vesna; SUKOP, Ivona. Listening to music as a teaching area in Croatian primary schools: the teacher's perspective. **Music Education Research**, London, v. 23, n. 3, p. 321-334, 2021.

TING, Daniel Shu Wei; CARIN, Lawrence; DZAU, Victor; WONG, Tien Y. Digital technology and COVID-19. **Nature Medicine**, London, v. 26, p. 459-461, 2020.

VARGO, Deedra; ZHU, Lin; BENWELL, Briana; YAN, Zheng. Digital technology use during COVID-19 pandemic: A rapid review.

Special Issue on COVID-19 and Human Behavior with Emerging Technologies, Hoboken, NJ, v. 3, n. 1, p. 13-24, 2021.

VENTURA, Michele Della. Creating Inspiring Learning Environments by Means of Digital Technologies: A Case Study of the Effectiveness of WhatsApp in Music Education. In: VINCENTI G.; BUCCIERO A.; HELFERT M.; GLOWATZ M. (Eds.). **E-Learning, E-Education, and Online Training**. Cham: Springer, 2017. p. 36-45.

WADDELL, George; WILLIAMON, Aaron. Technology Use and Attitudes in Music Learning. **Frontiers ICT**, Lausanne, v. 6, p. 11, 2019.

ZHU, Chang. Organisational culture and technology-enhanced innovation in higher education. **Technology, Pedagogy and Education**, London, v. 24, n. 1, p. 65-79, 2013.

Publisher

Federal University of Goiás. School of Music and Performing Arts. Graduate Program in Music. Publication in the Portal of Periodicals UFG.

The ideas expressed in this article are the responsibility of their authors, and do not necessarily represent the opinion of the editors or the university.