STUDIA UBB MUSICA, LXXI, 1, 2026 (p. 121 – 143)
(RECOMMENDED CITATION)
DOI: 10.24193/subbmusica.2026.1.06

BUILDING PROFESSIONAL COMPETENCE OF FUTURE MUSIC TEACHERS USING DIGITAL AND MULTIMEDIA TECHNOLOGIES WITH THE INVOLVEMENT OF CHOREOGRAPHIC ELEMENTS

LIUDMYLA I. PANKIV[1], OLHA CHURIKOVA-KUSHNIR[2], TETIANA BODROVA[3], HEORHII POSTEVKA[4], KSENIIA KOROTKEVYCH[5]

SUMMARY. The research presents the results of a pedagogical experiment aimed at improving the training of future music teachers in the context of digitalization of education and interspecific integration of arts. The relevance of the study is determined by the need to build a professional competence of future music teachers in the context of digital transformation of education and integration of artistic practices. The aim of the study was to identify and experimentally verify pedagogical conditions that ensure the effectiveness of the training of future music teachers. These conditions are a set of organizational, methodological, and technological factors (integration of digital and multimedia technologies, combination of musical and choreographic activities, development of reflection using multimedia, use of blended learning), which contribute to the development of students' key competencies. Research methods: pedagogical experiment (summative and formative stages), questionnaire, observation, statistical processing of results (Fisher's φ*-criterion, t-test, Cohen's d). The results showed a significant increase in the level of professional competence in the experimental group (EG): the share of

[1] *Doctor of Pedagogical Sciences, Professor, Department of Piano Performance and Art Pedagogy, Anatolii Avdiievskyi Faculty of Arts, Mykhailo Drahomanov Ukrainian State University, Kyiv, Ukraine, E-mail: pankivliudmyla123@gmail.com*

[2] *PhD in Pedagogical Sciences, Professor, Department of Music, Faculty of Pedagogy, Psychology and Social Work, Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine, E-mail: olhachurikova18@gmail.com*

[3] *PhD in Pedagogical Sciences, Professor, Department of Choral Conducting and Theory and Methods of Music Education, Faculty of Arts named alter Anatoliy Avdigevsky, Mykhailo Drahomanov Ukrainian State University, Kyiv, Ukraine, E-mail: tetianabodrova56@gmail.com*

[4] *PhD in Pedagogical Sciences, Assistant, Department of Music, Faculty of Pedagogy, Psychology and Social Work, Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine, E-mail: georgiypostevka@gmail.com*

[5] *PhD, Lecturer, Department of Choreography, Anatolii Avdiievskyi Faculty of Arts, Mykhailo Drahomanov Ukrainian State University, Kyiv, Ukraine, E-mail: bereziakkseniia@gmail.com*

students with a sufficient level increased from 47.0% to 72.2% (+25.2%), while the increase was only +6.2% in the control group (CG). The largest changes were recorded in communicative (+27.4%), as well as musical and choreographic (+26.8%) competencies. Statistical analysis confirmed the reliability of the differences ($p < 0.01$; Cohen's $d = 6.03$). Integration of digital and multimedia technologies with artistic practices, in particular elements of choreography, is an effective means of training future music teachers. The academic novelty is the integrated approach to the development of six competencies (digital, musical and pedagogical, artistic and creative, musical and choreographic, communicative, and reflective) and their experimental verification. Prospects for further research are related to the development of interdisciplinary courses and the expansion of the sample to other higher education institutions (HEIs).

Keywords: music pedagogy, music teachers, choreography, professional competence, innovative technologies, multimedia tools.

1. Introduction

Building of professional competence of future music teachers is a multidimensional process that encompasses the development of pedagogical, musical, performing, and creative skills in the face of modern challenges. AN increasing number of researchers note the need to update the training of music teachers by integrating digital and multimedia technologies.[6]

Currently, researchers emphasize that the digitalization of education contributes to the personalization of learning, expands the possibilities of creative self-realization of students, and increases the effectiveness of the development of pedagogical competencies. In particular, Blanco García et al.[7] prove that digital, as well as artistic and musical competencies are complementary components of the training of a modern teacher. The study by Luo et al.[8] shows that the use of multimedia tools (audio, video, interactive programmes) increases students' involvement and develops their readiness

[6] Pankiv, Liudmyla. "Features of the use of modern information technologies in the process of training future teachers of music and choreography." *Bulletin of the T. H. Shevchenko National University "Chernihiv Colehium"* 175.19 (2023): 155–160. https://doi.org/10.58407/231903

[7] Blanco García, Yurima, Serrano Pastor, Rosa M., & Casanova López, Óscar. "Toward a transversal education model: A review of digital and artistic-musical competencies (2014–2024)." *Arts Education Policy Review* 126.4 (2025): 1–15. https://doi.org/10.1080/10632913.2025.2459917

[8] Luo, Yan, Liu, Yaoping, Siripala, Wannaporn, Namtubtim, Noppavan, & Shen, Yi. "Incorporating multimedia learning into music teacher training program in rural Fujian." *Frontiers in Education* 10 (2025): 1531359. https://doi.org/10.3389/feduc.2025.1531359

to implement innovations in their own practice. Váradi et al.[9] draws similar conclusions, demonstrating an increase in the level of ICT competence of music teachers during distance learning during the pandemic.

In a systematic review, Liu et al.[10] emphasize that the effectiveness of digital tools in music education is determined not so much by their presence, but by the method of use. This is consistent with the results of O'Leary[11], who emphasizes the need to develop critical thinking and technological literacy of teachers.

At the same time, an interdisciplinary approach is relevant: the involvement of choreographic elements (movement, dance) in music and pedagogical training. According to Bilostotska[12], there is a fundamental connection between music and choreography, therefore it is important for future teachers to understand music not only as an accompaniment, but as a content-generating component of choreographic art. Such integration, as Ukrainian and foreign authors note, promises a more holistic training of specialists capable of working creatively and effectively in new educational conditions.

The aim of the study is to substantiate and determine the pedagogical conditions for building of professional competence of future music teachers through the integration of digital and multimedia technologies with the involvement of choreographic elements.

The aim was achieved through the fulfilment of the following research objectives:

- Analyse the current state of the problem in domestic and foreign research, identifying key trends in the use of digital and multimedia technologies in music and pedagogical training.

- Determine the possibilities of integrating choreographic elements into the process of professional training of music teachers as a factor in the development of their artistic and creative, as well as musical and choreographic competence.

---

[9] Váradi, Judit, Józsa, Gabriella, Fodor, Adrienne Sz., Molnár-Tamus, Viktória, & Szücs, Timea. "Investigating music teachers' ICT skills and technical possibilities in online music education during the COVID-19 pandemic." *Heliyon* 9.2 (2023): e16463. https://doi.org/10.1016/j.heliyon.2023.e16463

[10] Liu, Yihan, Tran, Van Cuong, Szabó, Norbert, & Tóth, Ali. "The use and effectiveness of digital tools in elementary music education: A systematic review." *Music & Science* 8 (2025): 1–23. https://doi.org/10.1177/20592043251363338

[11] O'Leary, Emmet. "Considering the possibilities and problems of AI in music education: The need for critical literacies." *Action, Criticism, and Theory for Music Education* 24.3 (2025): 138–164. Retrieved from: https://act.maydaygroup.org/considering-the-possibilities-and-problems-of-ai-in-music-education-the-need-for-critical-literacies/

[12] Bilostotska, O. V. "Essence of professional competence of future music teacher." *Педагогічні Науки: Реалії та Перспективи* 75.5 (2020): 39–44. https://doi.org/10.31392/NPU-nc.series5.2020.75.03

- Experimentally verify the effectiveness of combining digital and multimedia tools with elements of choreography to increase the level of professional competence of future music teachers.

2. Literature review

Global research shows that digitalization has become one of the leading trends in music education, but views on its role and boundaries differ significantly. The bibliometric analysis of Ma & Wang[13] systematized four main trends: interactivity, creativity, adaptability, and inclusiveness. Luo et al.[14] held a similar position, who emphasize the increase in student motivation through multimedia formats. At the same time, their results contradict the conclusions of Kakimova et al.[15]: the authors indicate that technologies are effective only if teachers are pedagogically prepared and cannot replace live artistic communication.

The COVID-19 pandemic has accelerated the rethinking of technological training for music teachers. Váradi et al.[16] and Biasutti et al.[17] emphasize that some teachers have become leaders in digital learning, while others have retained only basic skills. Similarly, Hash[18] warns that the success of distance learning depends not on the platform, but on the ability to integrate it into the specifics of the music subject. Therefore, technologies have potential, but need methodological support.

---

[13] Ma, Yidi, & Wang, Chengliang. “Empowering music education with technology: A bibliometric perspective.” *Humanities and Social Sciences Communications* 12.345 (2025). https://doi.org/10.1057/s41599-025-04616-2

[14] Luo, Yan, Liu, Yaoping, Siripala, Wannaporn, Namtubtim, Noppavan, & Shen, Yi. “Incorporating multimedia learning into music teacher training program in rural Fujian.” *Frontiers in Education* 10 (2025): 1531359. https://doi.org/10.3389/feduc.2025.1531359

[15] Kakimova, Laura, Sydykova, Rosa, Akhmetova, Aimkul, & Zhakaeva, Saltanat. “The use of modern digital technologies in the training of future music teachers.” *Scientific Herald of Uzhhorod University. Series “Physics”* 56 (2024): 2150–2159. https://doi.org/10.54919/physics/56.2024.215ya0

[16] Váradi, Judit, Józsa, Gabriella, Fodor, Adrienne Sz., Molnár-Tamus, Viktória, & Szücs, Timea. “Investigating music teachers’ ICT skills and technical possibilities in online music education during the COVID-19 pandemic.” *Heliyon* 9.2 (2023): e16463. https://doi.org/10.1016/j.heliyon.2023.e16463

[17] Biasutti, Michele, Antonini Philippe, Roberta, & Schiavio, Andrea. “E-learning during the COVID-19 lockdown: An interview study with primary school music teachers in Italy.” *International Journal of Music Education* 41.2 (2023): 242–255. https://doi.org/10.1177/02557614221107190

[18] Hash, Phillip. M. “Remote learning in school bands during the COVID-19 shutdown.” *Journal of Research in Music Education* 68.4 (2021): 381–397. https://doi.org/10.1177/0022429420967008

Christophersen[19] and Pankiv[20] converge in the assertion that innovations should not displace the traditional artistic component, but should deepen it. In contrast, Ma & Wang[21] emphasize the benefits of radical digital integration, where technology acts not as a tool, but as a learning environment. So, the common idea of most authors is the need for a balance between the technological and artistic components, but the boundary of this balance is interpreted differently.

Ukrainian and foreign studies agree on the importance of interspecific integration. Mikulinska et al.[22] and del Barrio & Arús[23] prove that the combination of music and movement develops rhythmicity, creativity, and empathy. Their approaches are close to the positions of Yu et al.[24] and Muzyka[25], who emphasize the integrity of professional training through the synthesis of music, choreography, and digital tools. However, Marievych et al.[26] emphasize that digital tools should only be auxiliary — excessive technologization can reduce the emotionality of the artistic experience. In general, most authors recognize the advantages of multimedia for interactivity and student

[19] Christophersen, Catharina. "Educating music teachers for the future: The crafts of change." In Mäki, I., Nikkanen, R., & Blix, G. (eds.) *Music Education as Craft: Reframing Theoretical and Practical Knowledge* (p. 63–74). Cham: Springer, 2021. https://doi.org/10.1007/978-3-030-67704-6_6

[20] Pankiv, Liudmyla. "Features of the use of modern information technologies in the process of training future teachers of music and choreography." *Bulletin of the T. H. Shevchenko National University "Chernihiv Colehium"* 175.19 (2023): 155–160. https://doi.org/10.58407/231903

[21] Ma, Yidi, & Wang, Chengliang. "Empowering music education with technology: A bibliometric perspective." *Humanities and Social Sciences Communications* 12.345 (2025). https://doi.org/10.1057/s41599-025-04616-2

[22] Mikulinska, Olha, Lisovska, Nina, & Troshchenko, Volodymyr. "Musical competence of future choreography teachers as an artistic and pedagogical problem." *Pedagogical Sciences: Theory, History, Innovation Technologies* 1.105 (2021): 426–433. https://repository.sspu.edu.ua/handle/123456789/11397

[23] Barrio del, Luis, & Arús, M. Eugénia. "Music and movement pedagogy in basic education: A systematic review." *Frontiers in Education* 9 (2024): 1403745. https://doi.org/10.3389/feduc.2024.1403745

[24] Yu, Xiaofei, Ma, Ning, Zheng, Lei, Wang, Licheng, & Wang, Kai. "Developments and applications of artificial intelligence in music education." *Technologies* 11.2 (2023): 42. https://doi.org/10.3390/technologies11020042

[25] Музика, Юрій. О. "Оптимальні педагогічні умови підготовки майбутніх учителів до реалізації інтегрованого підходу у навчанні народної хореографії." *Академічні Візії* 39 (2025): 37–45. https://doi.org/10.5281/zenodo.15121037

[26] Marievych, Nataliia, Kuziv, Mariia, Doroshenko, Tetiana, Aliksiichuk, Olena, Borysova, Tetiana, & Fedorchuk, Viktoriia. "Training future primary school teachers to organize game-based music activities." *Revista Românească pentru Educaţie Multidimensională* 14.1 (2022a): 15–31. https://doi.org/10.18662/rrem/14.1/505

motivation[27,28], but point to gaps in interdisciplinary methodology: mechanisms for harmonizing digital platforms with choreographic practice have not been developed. Schiavio et al.[29] emphasize that true innovation does not require new programmes, but a new pedagogical culture, where technological literacy is combined with creative thinking.

Therefore, two lines can be traced in the literature: an optimistic one[30,31], which sees digitalization as a catalyst for development, and a cautious one[32],[33],[34], which emphasizes the risks of losing emotionality and artistic authenticity. The synthesis of these positions that forms the methodological background for further research into the integration of digital and choreographic practices into music pedagogy.

3. Methods and Materials

The study was conducted in three consecutive stages: summative, formative, and control. At the summative stage, the initial level of professional

[27] Luo, Yan, Liu, Yaoping, Siripala, Wannaporn, Namtubtim, Noppavan, & Shen, Yi. "Incorporating multimedia learning into music teacher training program in rural Fujian." *Frontiers in Education* 10 (2025): 1531359. https://doi.org/10.3389/feduc.2025.1531359

[28] Marievych, Nataliia, Nesterovych, Bohdan, Turchyn, Tamara, Kryvosheya, Tetiana, Shyshova, Olha, & Nadon, Viktoriia. "Management of the play activity of primary schoolchildren: A critical look at Ukrainian trends from the point of view of international experience." *Revista Românească pentru Educaţie Multidimensională* 14.1Sup1 (2022b): 328–348. https://doi.org/10.18662/rrem/14.1Sup1/554

[29] Schiavio, Andrea, Biasutti, Michele, & Antonini Philippe, Roberta. "Creative pedagogies in the time of pandemic: A case study with conservatory students." *Music Education Research* 23.2 (2021): 167–178. https://doi.org/10.1080/14613808.2021.1881054

[30] Ma, Yidi, & Wang, Chengliang. "Empowering music education with technology: A bibliometric perspective." *Humanities and Social Sciences Communications* 12.345 (2025). https://doi.org/10.1057/s41599-025-04616-2

[31] Luo, Yan, Liu, Yaoping, Siripala, Wannaporn, Namtubtim, Noppavan, & Shen, Yi. "Incorporating multimedia learning into music teacher training program in rural Fujian." *Frontiers in Education* 10 (2025): 1531359. https://doi.org/10.3389/feduc.2025.1531359

[32] Kakimova, Laura, Sydykova, Rosa, Akhmetova, Aimkul, & Zhakaeva, Saltanat. "The use of modern digital technologies in the training of future music teachers." *Scientific Herald of Uzhhorod University. Series "Physics"* 56 (2024): 2150–2159. https://doi.org/10.54919/physics/56.2024.215ya0

[33] Christophersen, Catharina, Aróstegui, José Luis, Holdhus, Kari, Kenny, Ailbhe, Knudsen, Jan Sverre, Lindgren, Monica, Väkevä, Lauri, & Viig, Tine Grieg. "Music teacher education for the future: Reflections on change." *Action, Criticism, and Theory for Music Education* 22.3 (2023): 7–40. https://doi.org/10.22176/act22.3.7

[34] Marievych, Nataliia, Kuziv, Mariia, Doroshenko, Tetiana, Aliksiichuk, Olena, Borysova, Tetiana, & Fedorchuk, Viktoriia. "Training future primary school teachers to organize game-based music activities." *Revista Românească pentru Educaţie Multidimensională* 14.1 (2022a): 15–31. https://doi.org/10.18662/rrem/14.1/505

competence of future music teachers was determined, initial indicators were recorded for six key components (digital, musical and pedagogical, artistic and creative, musical and choreographic, communicative, reflective). At the formative stage, an experimental methodology was introduced that combined digital and multimedia technologies with the involvement of choreographic elements in the educational process. The control stage involved repeated measurement of competencies to identify the dynamics and statistically verified effect of the methodology.

The practical effectiveness of the experimental programme was increased by using a set of digital and multimedia tools, combining interactivity, creativity, and interdisciplinarity. These tools helped to organize students' musical and choreographic activities in a blended learning format – from creating scores to collective dance productions, online performances, and multimedia assessment.

Table 1 shows the main resources, their functional purpose, forms of students' work, and expected results.

Table 1

Item No.	Name of resource / platform	Type of technology	Functional purpose	Forms of student work	Expected results / competencies
1	**Padlet**	Multimedia interactive whiteboard	Collective creation of musical material, exchange of audio and video fragments, group discussion	Group projects, peer review	Development of communicative and digital competencies
2	**MuseScore**	Interactive music editor	Creation, editing and arrangement of scores; preparation of musical fragments for choreographic items	Individual practical tasks	Musical and pedagogical, artistic and creative competencies
3	**Audacity / Logic Pro X**	Audio editors	Processing of vocal and accompaniment recordings, creation of phonograms for dance productions	Individual and group projects	Artistic and creative and reflective competencies

4	**Zoom / Google Classroom**	Distance learning platforms	Conducting interactive classes, online concerts, joint discussion of choreographic productions	Seminars, group classes, online performances	Communicative and digital competence
5	**YouTube, Vimeo, AR platforms (Merge EDU, ARloopa)**	Multimedia resources and AR/VR tools	Analysis of video lessons, demonstration of movements, visualization of dance patterns	Independent work, reflective analysis	Musical and choreographic, reflective competence
6	**Canva / Genially**	Visual multimedia tools	Creation of educational presentations, posters, video posters for music and choreographic projects	Group mini-projects	Development of digital and artistic and creative competence
7	**Podcasts (Spotify, Anchor)**	Audio platforms for educational content	Listening to thematic audio podcasts on music pedagogy and choreography	Individual tasks with further discussion	Reflective, musical and pedagogical competence

Digital and multimedia resources used in the process of training future music teachers

* Developed by the authors

The use of these resources ensured a comprehensive coverage of the educational process — from technical (creation of musical fragments and video materials) to creative and reflective components. So, digital and multimedia technologies became not only an auxiliary tool, but a leading means of forming professional competence, combining musical, pedagogical, and choreographic components.

3.1. Research design

Pedagogical experiment was the main method that ensured the verification of the effectiveness of the integrated methodology. It involved the organization of two groups: experimental (EG) and control (CG), where the integrated use of digital and multimedia technologies in combination with choreographic practices was introduced only in the EG.

Questionnaire survey was used to identify students' subjective perception of the level of their own competencies, attitude to digital tools, and readiness for the integration of music and movement. The questionnaires contained closed and open questions, which allowed combining quantitative and qualitative analysis.

Pedagogical observation – was carried out during practical classes, where multimedia programs, interactive tasks and choreographic exercises were used. This made it possible to assess the dynamics of student involvement, their creative activity and communicative skills.

Statistical analysis – was used to confirm the reliability of the results obtained. The Fisher angular transformation criterion φ*, the t-test for independent samples, and the Cohen's d effect coefficient were applied, which allowed us to assess the strength of the impact of the implemented methodology.

Pedagogical observation was carried out during practical classes, where multimedia programmes, interactive tasks, and choreographic exercises were used. This made it possible to assess the dynamics of student involvement, their creative activity, and communication skills.

Statistical analysis was used to confirm the reliability of the obtained results. Fisher's angular transformation criterion φ*, t-test for independent samples, as well as Cohen's d effect coefficient were used to assess the strength of the impact of the implemented methodology.

3.2. Research sample

The general population consisted of students of the bachelor educational programme Musical Art and Choreography of higher education institutions (HEIs) of Ukraine. From this population, 200 students were selected using the method of purposeful selection from two leading pedagogical universities — Dragomanov Ukrainian State University and Yuriy Fedkovych Chernivtsi National University. The choice of these institutions is determined by the fact that they have powerful art and pedagogical schools that combine musical, choreographic, and digital training, as well as experience in implementing innovative forms of learning.

The sample included 2nd-3rd-year undergraduate students, as at this stage they have already mastered basic music theoretical and pedagogical subjects, have formed primary professional skills, but are still actively building professional competence. This makes it possible to effectively assess the dynamics of changes under the influence of the experiment.

The selection was carried out according to the following criteria:

– studying in one educational programme (Musical Art and Choreography);

– absence of significant differences in previous academic performance (average score within 80–85);

– approximately the same level of mastery of digital instruments, as well as basic musical and choreographic skills (determined by the results of the entrance questionnaire and diagnostics);

– voluntary participation in the study.

The EG and CG were formed taking into account the principle of equivalence: the initial indicators of professional competence levels did not differ statistically ($p > 0.05$), which ensured the validity of the comparison of results.

3.3. Research tools

The following were used to implement the experimental programme:

- Multimedia platforms (Zoom, Google Classroom, Padlet) for interactive interaction and exchange of educational materials;

- Music software (MuseScore, Audacity, Logic Pro X) — for creating and analysing musical material;

- Digital resources on choreography (video lessons, movement simulations, interactive exercises), which were integrated into the educational process;

- Assessment methods — an author's map for assessing the formation of competencies, which took into account six components, as well as standardized tests on pedagogy and digital literacy;

- Statistical analysis formulas: Fisher's φ* test for testing differences in percentages; t-test for independent samples for comparing mean values between groups; Cohen's d coefficient for assessing the strength of the impact.

The level of professional competencies was determined by using an author's assessment map developed taking into account six components (digital, musical and pedagogical, artistic and creative, musical and choreographic, communicative, and reflective). Each component was assessed on a three-point scale of levels:

1 - initial (fragmentary knowledge, low activity in digital artistic activities),

2 - reproductive (stable performance of tasks according to the model, partial independence),

3 - sufficient (conscious, independent, creatively justified use of technologies and artistic means).

Table 2

Criterion	Indicators	Levels of development
Knowledge of digital tools	Knowledge of MuseScore, Padlet, Canva, Audacity	1 – knows individual tools; 2 – confidently uses the main ones; 3 – integrates them into creative tasks
Practical skills	Creating multimedia products	1 – with the help of a teacher; 2 – partially independently; 3 – completely independently, with creative additions
Reflection and self-monitoring	Evaluates the effectiveness of one's own work	1 – does not implement; 2 – partially; 3 – systematically applies reflection

Fragment of the assessment map (example for digital competence)
* Developed by the authors

The questionnaire included 18 questions (open and closed), covering three blocks: self-assessment of the level of competences (on a scale of 1–5); attitude to digital technologies and choreographic integration; willingness to use multimedia in one's own pedagogical activities.

Example of a question: *"How regularly do you use online platforms (Padlet, MuseScore, Canva) in the process of creating educational resources"*

The answers were recorded on a five-point scale (1 – never, 5 – constantly).

The validity of the instruments was checked by expert assessment (5 teachers of music and pedagogical subjects, 3 choreographic pedagogy, 2 ICT specialists). The consistency of the experts' assessments was 0.87 (Kendall W coefficient), which indicates a high level of internal consistency of the indicators. The reliability of the questionnaire was checked by calculating Cronbach's α coefficient = 0.84, which corresponds to high internal consistency of the scale.

4. Results

Analysis of the dynamics of the levels of professional competence of future music teachers in the EG and CG showed a significant difference in the results. At the summative stage, both groups had a similar distribution of levels: the reproductive level dominated (more than half of the students), a significant proportion was at the initial level, and the sufficient level was represented by less than a fifth of the participants. This indicates the initial conditions of the experiment, when most students needed targeted work to improve their professional competence (Table 3).

Table 3

Item No.	Competencies	CG, % (before)	CG, % (after)	Change	EG, % (before)	EG, % (after)	Δ (change, pp)
1	Digital	50.2	59.8	+9.6	49.5	74.2	+24.7
2	Musical and pedagogical	53.1	61.0	+7.9	52.8	72.1	+19.3
3	Artistic and creative	48.7	60.1	+11.4	49.0	70.3	+21.3
4	Musical and choreographic	45.0	54.5	+9.5	44.7	71.5	+26.8
5	Communicative	46.2	55.0	+8.8	45.9	73.3	+27.4
6	Reflective	51.0	60.4	+9.4	50.7	71.8	+21.1
	Total competence	**49.0**	**58.5**	**+9.5**	**48.8**	**72.2**	**+23.4**

Dynamics of the development of professional competence of future music teachers by types of competencies at the beginning and end of the experiment (in %)

* Developed by the authors

The obtained data demonstrate a significant difference in the dynamics of the development of professional competencies. In the CG, the increase was on average only +9.5 pp, while in the EG - +23.4 pp, that is, more than twice as much. The most noticeable changes were recorded in communicative (+27.4 pp) and musical-choreographic (+26.8 pp) competencies, which indicates the success of combining digital and choreographic practices. Significant improvement is also observed in digital (+24.7 pp), artistic and creative (+21.3 pp), and reflective (+21.1 pp) competencies, while the corresponding indicators do not exceed +11.4 pp in the CG.

Overall, the proportion of the EG students with a sufficient level of professional competence increased from 48.8% to 72.2%, while it increased only from 49.0% to 58.5% in the CG. This indicates a statistically significant effectiveness of the implemented methodology and confirms that the integration of digital and multimedia technologies with choreographic elements contributes to a comprehensive increase in the professional competence of future music teachers.

The generalized data (Table 4) demonstrate changes in the levels of professional competencies of future music teachers after the experiment. The reproductive level prevailed (56–61%) at the summative stage, a significant proportion of students had the initial level (20–23%), while the sufficient level fluctuated within 18–22%. This indicates the same starting conditions and the need to improve students' training.

Table 4

Competence	Summative stage (%)			Control stage (%)		
	Sufficient level	Reproductive level	Initial level	Sufficient level	Reproductive level	Initial level
Digital	20	58	22	50	45	5
Musical and pedagogical	22	56	22	48	46	6
Artistic and creative	19	61	20	46	48	6
Musical and choreographic	18	59	23	55	40	5
Communicative	19	58	23	56	41	3
Reflective	21	57	22	49	46	5

Generalized results of the level of professional competencies of future music teachers (N=100, EG)

* Developed by the authors

At the formative stage, the EG observed a significant increase in the sufficient level in almost all competencies, especially in communicative, as well as musical and choreographic, where the number of students with high indicators more than doubled. At the same time, the share of the initial level decreased significantly, which testifies to the effectiveness of the implemented pedagogical conditions. In the CG, the dynamics of changes is minimal: a slight increase in the sufficient level and an almost unchanged share of the initial. This indicates that traditional training provides only gradual progress, while experimental conditions give a significantly better result.

The practical impact of the methodology was assessed by analysing the dynamics of the use of digital and multimedia tools by students before and after the experiment. This made it possible to determine which technologies were most actively integrated into the educational process and contributed to the development of professional competencies (Table 5).

Table 5

Item No.	Digital tool	Before the experiment	After the experiment	Δ (change, pp)
1	MuseScore (music score editor)	42.0	78.5	+36.5
2	Padlet (online collaboration)	28.7	71.2	+42.5
3	Canva / Genially (visual multimedia)	31.5	69.0	+37.5
4	Zoom / Google Classroom	88.0	94.5	+6.5
5	Audacity / Logic Pro X	25.4	63.8	+38.4
6	YouTube / AR platforms	36.9	75.1	+38.2
Average indicator	—	**42.1**	**75.3**	**+33.2**

Use of digital and multimedia tools by students before and after the experiment (EG, % of the total number)
* Developed by the authors

The data show that after the formative stage, students in the EG used digital tools much more actively, especially those related to collaboration (Padlet), multimedia creation (Canva, Genially), and musical editing (MuseScore). The increase is on average more than 30 pp, which confirms the practical effect of integrating technologies into the educational process.

To check the statistical reliability of the obtained data, the Fisher's angular transformation criterion (φ*), t-test for independent samples and the Cohen's effect size (d) were applied. The results confirmed that the increase in the proportion of students with a sufficient level of professional competence in the EG is statistically proven and reliable: *$\varphi = 2.56 \geq \varphi cr = 2.31$ ($p \leq 0.01$). The t-test also showed a significant difference between the CG and the EG after the formative stage ($t = -10.45$; $p < 0.001$). The calculation of the Cohen effect size ($d = 6.03$) demonstrated an extremely strong influence of the experimental method on the development of professional competence of future music teachers. So, the integration of digital and multimedia technologies with choreographic elements has proven its effectiveness in the students' training.

After participating in the experimental programme, students demonstrated not only an increase in the level of competencies, but also significant changes in attitudes: increased interest, belief in one's own abilities, and understanding of the pedagogical value of technologies (Table 6). So, the experiment had both a cognitive and motivational effect.

Table 6

Indicator (on a scale of 1–5)	Before the experiment (M±SD)	After the experiment (M±SD)	t	p
Interest in using digital tools	3.4 ± 0.8	4.6 ± 0.5	10.2	<0.001
Confidence in one's own skills	3.1 ± 0.9	4.4 ± 0.6	9.8	<0.001
Perception of digital technologies as a pedagogical resource	3.5 ± 0.7	4.7 ± 0.4	11.0	<0.001
Convinced of the feasibility of combining music and choreography through digital means	3.2 ± 0.8	4.5 ± 0.5	10.6	<0.001

Changes in students' attitudes towards the use of digital technologies (EG, n=100)

* Developed by the authors

The obtained results indicate a significant increase in the positive attitude of the EG students towards the use of digital technologies in learning. The average level of interest increased from 3.4 ± 0.8 to 4.6 ± 0.5 points, i.e. by +1.2 points ($t = 10.2$; $p < 0.001$), which reflects a noticeable increase in motivation for digital activity. Confidence in one's own skills increased from 3.1 ± 0.9 to 4.4 ± 0.6 points (+1.3 points), and the perception of digital technologies as a pedagogical resource increased from 3.5 ± 0.7 to 4.7 ± 0.4 points (+1.2 points), with high statistical significance ($t = 11.0$; $p < 0.001$). The largest shift was recorded in the indicator of conviction in the feasibility of combining music and choreography through digital means – from 3.2 ± 0.8 to 4.5 ± 0.5 points (+1.3 points; $t = 10.6$; $p < 0.001$). In general, there is a pronounced positive dynamics of all four indicators: the average increase was about +1.25 points on a five-point scale, which indicates not only the development of digital skills, but also a change in students' value orientations towards the conscious use of technologies in artistic and pedagogical activities.

During the observation, teachers noted that students became more proactive in creating multimedia projects, more often offered their own options for choreographic accompaniment, actively used video analysis of performances and self-assessment. The increase in communicative interaction during group classes in Zoom and Padlet was the most noticeable. The students associated some difficulties with technical barriers (unstable Internet connection, lack of licensed software), but most of them noted that these problems did not reduce motivation for digital learning.

5. Discussion

The low level of professional competence of future music teachers remains one of the main problems of art education.[35,36] Researchers see the reasons in the inertia of educational programmes[37] and the insufficient development of digital literacy.[38] Our results confirm both theses and complement them: what is decisive is not the mere fact of the presence of technologies, but their integration with creative activities, in particular choreography. Sandberg-Jurström et al.[39] proposed a transversal model of digital and artistic competencies, but it is based mainly on students' self-assessment. Our experiment, based on objective growth indicators (digital competence +24.7 pp, musical-choreographic +26.8 pp), empirically confirmed the effectiveness of such an integration model. On the other hand, Zhang et al.[40] believe that the main barrier is not the methodology, but the attitude of teachers towards technology. We partially agree: attitude is indeed an important factor, but our data showed that a change in attitude is possible through practical involvement in digital choreographic projects (increased interest in technology from 3.4 to 4.6 points; $p<0.001$).

---

[35] Christophersen, Catharina, Aróstegui, José Luis, Holdhus, Kari, Kenny, Ailbhe, Knudsen, Jan Sverre, Lindgren, Monica, Väkevä, Lauri, & Viig, Tine Grieg. "Music teacher education for the future: Reflections on change." *Action, Criticism, and Theory for Music Education* 22.3 (2023): 7–40. https://doi.org/10.22176/act22.3.7

[36] Melnyk, Khrystyna P. "Formation of professional competence of future music art teachers by means of digital technologies in modern science and practice." *Pedagogical Academy: Scientific Notes* 14 (2025). https://doi.org/10.5281/zenodo.14955824

[37] Christophersen, Catharina, Aróstegui, José Luis, Holdhus, Kari, Kenny, Ailbhe, Knudsen, Jan Sverre, Lindgren, Monica, Väkevä, Lauri, & Viig, Tine Grieg. "Music teacher education for the future: Reflections on change." *Action, Criticism, and Theory for Music Education* 22.3 (2023): 7–40. https://doi.org/10.22176/act22.3.7

[38] Онофрійчук, Людмила В., Червоній, Марія П., Лановенко, Наталія В., & Газінська, Олеся В. "Формування інформаційно-комунікаційної компетентності майбутнього вчителя музичного мистецтва у процесі інтегрованого навчання." *Мистецтво в Культурі Сучасності: Теорія та Практика Навчання* 4 (2025): 60–66. https://doi.org/10.31652/3041-1017-2024(4)-08

[39] Sandberg-Jurström, Ragnhild, & Lindgren, Monica. "Mapping the applicants' learnability: A discourse analysis of assessors' talk of admission tests for Swedish specialist music teacher education." *Music Education Research* 24.5 (2022): 599–610. https://doi.org/10.1080/14613808.2022.2098263

[40] Zhang, Xiangming, King, Andrew, & Prior, Helen. "Attitudes before actions: How music teachers' technological acceptance and competence shape technological behaviour in China." *Humanities and Social Sciences Communications* 12.1 (2025): 1–12. https://doi.org/10.1057/s41599-025-05582-5

Some authors, such as Kakimova et al.[41] and O'Leary[42], warn of the risk of "technological dominance" when ICTs displace live music making. Our observations confirm that such a risk exists, but under the conditions of thoughtful integration of technologies into choreographic and musical-creative tasks, it disappears: on the contrary, students' emotional interaction increases (increase in communicative competence by +27.4 pp).

Our study complements and expands previous works[43,44], demonstrating that the combination of digital and choreographic practices not only improves technical skills, but also creates a holistic model of the development of six interrelated competencies. A gap in most studies remains the lack of experimental testing of such models, which our study carried out for the first time in the Ukrainian context.

Our results confirmed the effectiveness of the integrated methodology: in the EG, all competencies increased significantly, especially communicative (+27.4%) and musical-choreographic (+26.8%). This is consistent with the findings of Blanco García et al.[45], del Barrio and Arús[46] and Kibirige[47], who prove that the combination of technology and arts, in particular music and movement, enhances students' motivation and creativity. Unlike most studies that considered individual aspects, ours covered six competencies and

---

[41] Kakimova, Laura, Sydykova, Rosa, Akhmetova, Aimkul, & Zhakaeva, Saltanat. "The use of modern digital technologies in the training of future music teachers." *Scientific Herald of Uzhhorod University. Series "Physics"* 56 (2024): 2150–2159. https://doi.org/10.54919/physics/56.2024.215ya0

[42] O'Leary, Emmet. "Considering the possibilities and problems of AI in music education: The need for critical literacies." *Action, Criticism, and Theory for Music Education* 24.3 (2025): 138–164. Retrieved from: https://act.maydaygroup.org/considering-the-possibilities-and-problems-of-ai-in-music-education-the-need-for-critical-literacies/

[43] Ma, Yidi, & Wang, Chengliang. "Empowering music education with technology: A bibliometric perspective." *Humanities and Social Sciences Communications* 12.345 (2025). https://doi.org/10.1057/s41599-025-04616-2

[44] Marievych, Nataliia, Nesterovych, Bohdan, Turchyn, Tamara, Kryvosheya, Tetiana, Shyshova, Olha, & Nadon, Viktoriia. "Management of the play activity of primary schoolchildren: A critical look at Ukrainian trends from the point of view of international experience." *Revista Românească pentru Educaţie Multidimensională* 14.1Sup1 (2022b): 328–348. https://doi.org/10.18662/rrem/14.1Sup1/554

[45] Blanco García, Yurima, Serrano Pastor, Rosa M., & Casanova López, Óscar. "Toward a transversal education model: A review of digital and artistic-musical competencies (2014–2024)." *Arts Education Policy Review* 126.4 (2025): 1–15. https://doi.org/10.1080/10632913.2025.2459917

[46] Barrio del, Luis, & Arús, M. Eugénia. "Music and movement pedagogy in basic education: A systematic review." *Frontiers in Education* 9 (2024): 1403745. https://doi.org/10.3389/feduc.2024.1403745

[47] Kibirige, Ronald. "Dance-Musicking: Non-prescriptive dance, music, and dance-music engagement in cross-sectoral collaborative teaching and learning." *Dance Articulated* 9.1 (2023). https://doi.org/10.5324/da.v9i1.5055

recorded statistically significant growth in all areas. While Cuervo et al.[48] linked digital technologies only with the development of social responsibility, our experiment proved that the combination of ICT and artistic-choreographic practices provides a comprehensive increase in competence (+23.4% vs. +9.5% in the CG).

In a systematic review, Liu et al.[49] showed that the effectiveness of digital tools in music education is variable: they enhance motivation and understanding of the material, but do not guarantee stable results. Our data confirm and complement this: technologies give maximum effect only if integrated into the interdisciplinary context of "music + choreography". In the CG, where only basic ICT was used, the increase in competences was minimal. Therefore, the decisive factor is the methodology of application, not the tools themselves. Our experiment demonstrated that such a methodology provides an extremely strong effect (Cohen's $d = 6.03$; $p < 0.001$). Our experiment showed a clear quantitative increase in students' professional skills, which was confirmed statistically. This may be explained by the greater intensity and duration of our impact or by the fact that our methodology purposefully developed practical skills (unlike the aforementioned study, where the main emphasis was on changing teachers' attitudes and beliefs). It is also worth considering that our students had a high level of initial motivation and openness to innovation – modern research indicates that the generation of new teachers has a fairly high level of digital literacy and confidence in using technologies.[50] This probably contributed to the successful acquisition of new tools within our programme. Ukrainian research also emphasizes the need for digital transformation and an integrated approach in art education.[51,52] Our methodology practically implements these ideas:

[48] Cuervo, Laura, Bonastre, Carolina, Camilli, Celia, Arroyo, Delia, & García, Desirée. "Digital competences in teacher training and music education via service learning: A mixed-method research project." *Education Sciences* 13.5 (2023): 459. https://doi.org/10.3390/educsci13050459

[49] Liu, Yihan, Tran, Van Cuong, Szabó, Norbert, & Tóth, Ali. "The use and effectiveness of digital tools in elementary music education: A systematic review." *Music & Science* 8 (2025): 1–23. https://doi.org/10.1177/20592043251363338

[50] Kılınçer, Özlem. "Investigation of music teacher candidates' technology integration self-efficacy and artificial intelligence literacy." *International Journal of Modern Education Studies* 9.2 (2025): 356–384. https://doi.org/10.51383/ijonmes.2025.417

[51] Онофрійчук, Людмила В., Червоній, Марія П., Лановенко, Наталія В., & Газінська, Олеся В. "Формування інформаційно-комунікаційної компетентності майбутнього вчителя музичного мистецтва у процесі інтегрованого навчання." *Мистецтво в Культурі Сучасності: Теорія та Практика Навчання* 4 (2025): 60–66. https://doi.org/10.31652/3041-1017-2024(4)-08

[52] Melnyk, Khrystyna P. "Formation of professional competence of future music art teachers by means of digital technologies in modern science and practice." *Pedagogical Academy: Scientific Notes* 14 (2025). https://doi.org/10.5281/zenodo.14955824

the combination of musical and choreographic practices with ICT ensured an increase in students' digital competence from 20% to 50% and a doubling of the share of highly competent teachers.

Most contemporary authors emphasize the need to develop digital literacy and creativity of music teachers in the conditions of the "new normal".[53] The COVID-19 pandemic has only accelerated this process, revealing the weaknesses of the traditional system[54,55] and stimulating innovation.[56]

Our experimental approach confirmed that gradual changes are ineffective: only the systemic integration of digital and choreographic practices yields a breakthrough result (Cohen's $d \approx 6$). In contrast to theoretical or partial models,[57] we experimentally proved the complex impact of digital-choreographic integration on students' professional competence ($N = 100$).

In summary, the results of our study are generally consistent with current academic trends in digitalization and arts integration in the training of music educators.[58] We confirmed in practice what theorists previously stated: the combination of technology, music, and movement can form a wide range of high-level competencies in future teachers. The difference of our approach is its comprehensiveness and experimental verification. So, our study eliminates the shortcomings of some predecessors and makes a significant contribution to confirming the effectiveness of integrated pedagogical technologies.

---

[53] Hash, Phillip. M. "Remote learning in school bands during the COVID-19 shutdown." *Journal of Research in Music Education* 68.4 (2021): 381–397. https://doi.org/10.1177/0022429420967008

[54] Cheng, Lee, Lam, Chi Ying, & Leung, Chi Hin. "Digital competencies of music teachers under the "new normal" in Hong Kong." *International Journal of Music Education* 42.4 (2024): 535–549. https://doi.org/10.1177/02557614231186413

[55] Tran Quoc Viet, & Do Thi Mai An. "Integrating music and dance: Challenges and solutions for effective teaching." *Educational Point* 2.1 (2025): e113. https://doi.org/10.71176/EDUP/16092

[56] Schiavio, Andrea, Biasutti, Michele, & Antonini Philippe, Roberta. "Creative pedagogies in the time of pandemic: A case study with conservatory students." *Music Education Research* 23.2 (2021): 167–178. https://doi.org/10.1080/14613808.2021.1881054

[57] Zhang, Xiangming, King, Andrew, & Prior, Helen. "Attitudes before actions: How music teachers' technological acceptance and competence shape technological behaviour in China." *Humanities and Social Sciences Communications* 12.1 (2025): 1–12. https://doi.org/10.1057/s41599-025-05582-5

[58] Yu, Xiaofei, Ma, Ning, Zheng, Lei, Wang, Licheng, & Wang, Kai. "Developments and applications of artificial intelligence in music education." *Technologies* 11.2 (2023): 42. https://doi.org/10.3390/technologies11020042

5.1. Limitations

The study was conducted on a sample of students at a single HEI, which may limit the generalizability of the results to a broader context. In addition, the experimental period was relatively short, so not all long-term effects could be observed.

5.2. Recommendations

It is appropriate to expand such studies to other institutions and cover a longer time interval, which will allow to check the consistency of the obtained results. A practical recommendation is the creation of interdisciplinary courses that integrate music, choreography and digital technologies, as well as the systematic improvement of teachers' digital literacy.

6. Conclusions

The obtained results convincingly prove the effectiveness of integrating digital and multimedia technologies with choreographic elements in the training of future music teachers. In the EG, a significant increase in all types of competencies was recorded, especially communicative (+27.4 pp), as well as musical and choreographic (+26.8 pp), while the increase was minimal in the CG (+7–11 pp). The generalized data indicate a significant increase in the proportion of students with a sufficient level while simultaneously reducing the initial level by more than three times.

Statistical testing confirmed the reliability of these results: $*\varphi = 2.56 \geq \varphi cr = 2.31$ ($p \leq 0.01$)**; $t = -10.45$; $p < 0.001$. The effect size according to Cohen ($d = 6.03$) indicates an extremely strong influence of the applied methodology. Thus, the implemented pedagogical conditions not only increased the overall level of professional competence, but also ensured the comprehensive development of its key components. This confirms the feasibility of using an innovative approach focused on the synergy of digital technologies, multimedia and choreography in the professional training of music teachers.

Statistical testing confirmed the reliability of these results: $*\varphi = 2.56 \geq \varphi cr = 2.31$ ($p \leq 0.01$)**; $t = -10.45$; $p < 0.001$. The Cohen's effect size ($d = 6.03$) indicates an extremely strong influence of the applied methodology. So, the implemented pedagogical conditions not only increased the overall level of professional competence, but also ensured the comprehensive development of its key components. This confirms the appropriateness of using an innovative approach focused on the synergy of digital technologies, multimedia, and choreography in the professional training of music teachers.

REFERENCES

Barrio del, Luis, & Arús, M. Eugénia. “Music and movement pedagogy in basic education: A systematic review.” *Frontiers in Education* 9 (2024): 1403745. https://doi.org/10.3389/feduc.2024.1403745

Biasutti, Michele, Antonini Philippe, Roberta, & Schiavio, Andrea. “E-learning during the COVID-19 lockdown: An interview study with primary school music teachers in Italy.” *International Journal of Music Education* 41.2 (2023): 242–255. https://doi.org/10.1177/02557614221107190

Bilostotska, O. V. “Essence of professional competence of future music teacher.” *Педагогічні Науки: Реалії та Перспективи* 75.5 (2020): 39–44. https://doi.org/10.31392/NPU-nc.series5.2020.75.03

Blanco García, Yurima, Serrano Pastor, Rosa M., & Casanova López, Óscar. “Toward a transversal education model: A review of digital and artistic-musical competencies (2014–2024).” *Arts Education Policy Review* 126.4 (2025): 1–15. https://doi.org/10.1080/10632913.2025.2459917

Cheng, Lee, Lam, Chi Ying, & Leung, Chi Hin. “Digital competencies of music teachers under the “new normal” in Hong Kong.” *International Journal of Music Education* 42.4 (2024): 535–549. https://doi.org/10.1177/02557614231186413

Christophersen, Catharina. “Educating music teachers for the future: The crafts of change.” In Mäki, I., Nikkanen, R., & Blix, G. (eds.) *Music Education as Craft: Reframing Theoretical and Practical Knowledge* (p. 63–74). Cham: Springer, 2021. https://doi.org/10.1007/978-3-030-67704-6_6

Christophersen, Catharina, Aróstegui, José Luis, Holdhus, Kari, Kenny, Ailbhe, Knudsen, Jan Sverre, Lindgren, Monica, Väkevä, Lauri, & Viig, Tine Grieg. “Music teacher education for the future: Reflections on change.” *Action, Criticism, and Theory for Music Education* 22.3 (2023): 7–40. https://doi.org/10.22176/act22.3.7

Cuervo, Laura, Bonastre, Carolina, Camilli, Celia, Arroyo, Delia, & García, Desirée. “Digital competences in teacher training and music education via service learning: A mixed-method research project.” *Education Sciences* 13.5 (2023): 459. https://doi.org/10.3390/educsci13050459

Hash, Phillip. M. “Remote learning in school bands during the COVID-19 shutdown.” *Journal of Research in Music Education* 68.4 (2021): 381–397. https://doi.org/10.1177/0022429420967008

Kakimova, Laura, Sydykova, Rosa, Akhmetova, Aimkul, & Zhakaeva, Saltanat. “The use of modern digital technologies in the training of future music teachers.” *Scientific Herald of Uzhhorod University. Series “Physics”* 56 (2024): 2150–2159. https://doi.org/10.54919/physics/56.2024.215ya0

Kibirige, Ronald. “Dance-Musicking: Non-prescriptive dance, music, and dance-music engagement in cross-sectoral collaborative teaching and learning.” *Dance Articulated* 9.1 (2023). https://doi.org/10.5324/da.v9i1.5055

Kılınçer, Özlem. “Investigation of music teacher candidates’ technology integration self-efficacy and artificial intelligence literacy.” *International Journal of Modern Education Studies* 9.2 (2025): 356–384. https://doi.org/10.51383/ijonmes.2025.417

Liu, Yihan, Tran, Van Cuong, Szabó, Norbert, & Tóth, Ali. “The use and effectiveness of digital tools in elementary music education: A systematic review.” *Music & Science* 8 (2025): 1–23. https://doi.org/10.1177/20592043251363338

Luo, Yan, Liu, Yaoping, Siripala, Wannaporn, Namtubtim, Noppavan, & Shen, Yi. “Incorporating multimedia learning into music teacher training program in rural Fujian.” *Frontiers in Education* 10 (2025): 1531359. https://doi.org/10.3389/feduc.2025.1531359

Ma, Yidi, & Wang, Chengliang. “Empowering music education with technology: A bibliometric perspective.” *Humanities and Social Sciences Communications* 12.345 (2025). https://doi.org/10.1057/s41599-025-04616-2

Marievych, Nataliia, Kuziv, Mariia, Doroshenko, Tetiana, Aliksiichuk, Olena, Borysova, Tetiana, & Fedorchuk, Viktoriia. “Training future primary school teachers to organize game-based music activities.” *Revista Românească pentru Educaţie Multidimensională* 14.1 (2022a): 15–31. https://doi.org/10.18662/rrem/14.1/505

Marievych, Nataliia, Nesterovych, Bohdan, Turchyn, Tamara, Kryvosheya, Tetiana, Shyshova, Olha, & Nadon, Viktoriia. “Management of the play activity of primary schoolchildren: A critical look at Ukrainian trends from the point of view of international experience.” *Revista Românească pentru Educaţie Multidimensională* 14.1Sup1 (2022b): 328–348. https://doi.org/10.18662/rrem/14.1Sup1/554

Melnyk, Khrystyna P. “Formation of professional competence of future music art teachers by means of digital technologies in modern science and practice.” *Pedagogical Academy: Scientific Notes* 14 (2025). https://doi.org/10.5281/zenodo.14955824

Mikulinska, Olha, Lisovska, Nina, & Troshchenko, Volodymyr. “Musical competence of future choreography teachers as an artistic and pedagogical problem.” *Pedagogical Sciences: Theory, History, Innovation Technologies* 1.105 (2021): 426–433. https://repository.sspu.edu.ua/handle/123456789/11397

Музика, Юрій. О. “Оптимальні педагогічні умови підготовки майбутніх учителів до реалізації інтегрованого підходу у навчанні народної хореографії.” *Академічні Візії* 39 (2025): 37–45. https://doi.org/10.5281/zenodo.15121037

O’Leary, Emmet. “Considering the possibilities and problems of AI in music education: The need for critical literacies.” *Action, Criticism, and Theory for Music Education* 24.3 (2025): 138–164. Retrieved from: https://act.maydaygroup.org/considering-the-possibilities-and-problems-of-ai-in-music-education-the-need-for-critical-literacies/

Онофрійчук, Людмила В., Червоній, Марія П., Лановенко, Наталія В., & Газінська, Олеся В. “Формування інформаційно-комунікаційної компетентності майбутнього вчителя музичного мистецтва у процесі інтегрованого навчання.” *Мистецтво в Культурі Сучасності: Теорія та Практика Навчання* 4 (2025): 60–66. https://doi.org/10.31652/3041-1017-2024(4)-08

Pankiv, Liudmyla. “Features of the use of modern information technologies in the process of training future teachers of music and choreography.” *Bulletin of the T. H. Shevchenko National University “Chernihiv Colehium”* 175.19 (2023): 155–160. https://doi.org/10.58407/231903

Sandberg-Jurström, Ragnhild, & Lindgren, Monica. “Mapping the applicants’ learnability: A discourse analysis of assessors’ talk of admission tests for Swedish specialist music teacher education.” *Music Education Research* 24.5 (2022): 599–610. https://doi.org/10.1080/14613808.2022.2098263

Sannino, Annalisa. “Transformative agency as warping: How collectives accomplish change amidst uncertainty.” *Pedagogy, Culture & Society* 30.1 (2022): 9–33. https://doi.org/10.1080/14681366.2020.1805493

Schiavio, Andrea, Biasutti, Michele, & Antonini Philippe, Roberta. “Creative pedagogies in the time of pandemic: A case study with conservatory students.” *Music Education Research* 23.2 (2021): 167–178. https://doi.org/10.1080/14613808.2021.1881054

Tran Quoc Viet, & Do Thi Mai An. “Integrating music and dance: Challenges and solutions for effective teaching.” *Educational Point* 2.1 (2025): e113. https://doi.org/10.71176/EDUP/16092

Váradi, Judit, Józsa, Gabriella, Fodor, Adrienne Sz., Molnár-Tamus, Viktória, & Szücs, Timea. “Investigating music teachers’ ICT skills and technical possibilities in online music education during the COVID-19 pandemic.” *Heliyon* 9.2 (2023): e16463. https://doi.org/10.1016/j.heliyon.2023.e16463

Yu, Xiaofei, Ma, Ning, Zheng, Lei, Wang, Licheng, & Wang, Kai. “Developments and applications of artificial intelligence in music education.” *Technologies* 11.2 (2023): 42. https://doi.org/10.3390/technologies11020042

Zhang, Xiangming, King, Andrew, & Prior, Helen. “Attitudes before actions: How music teachers’ technological acceptance and competence shape technological behaviour in China.” *Humanities and Social Sciences Communications* 12.1 (2025): 1–12. https://doi.org/10.1057/s41599-025-05582-5