

THE IMPACT OF MODERN TECHNOLOGIES ON THE DEVELOPMENT OF MUSICAL ABILITIES AND CREATIVITY IN HIGHER EDUCATION INSTITUTIONS




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Abstract. *Observing the development of music pedagogy as a science, it is difficult to imagine the teaching process in the modern era without the integration of contemporary technology. The use of smartphones, tablet computers, and auxiliary tools in Solfège instruction, such as smartboards, audio CD players, projectors, MIDI controllers, and keyboards, represents one of the most significant advancements in the effective delivery of music education today. This paper presents the results of a study conducted to examine the use of smart devices in the implementation of Solfège teaching content. Based on this, an analysis was carried out on a representative sample using both qualitative and quantitative research methods. The findings highlight the advantages and limitations of modern digital teaching tools. The research concluded that students hold a positive view regarding the use of modern technologies in Solfège instruction, recognize the competence of professors and teaching assistants in utilizing these technologies, and believe that their application can enhance the creativity of both instructors and assistants.*

Key words: *Solfège, music theory, contemporary technologies, pedagogy, musical literacy, musical ability, and creativity.*

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1. INTRODUCTION

In order to acquire knowledge, humans have continually sought ways to make the learning process more efficient and effective, with the aim of improving their lives. Throughout history, the study of music has involved a diverse range of figures, including ancient Greek philosophers, mathematicians, clergy, physicists, performers, composers, and educators. In the modern world, music study continues to involve a wide spectrum of professionals including music theorists, musicologists, music educators, and ethnomusicologists. Music education fulfills the human need for learning, discovery, and understanding the unknown, aligning with fundamental cultural needs, which also encompass linguistic, aesthetic, and creative artistic needs (Dragičević Šešić & Stojković, 2007). The primary goal of music education is musical literacy, which is most effectively achieved through the subject of Solfège, beginning from the earliest stages of instruction.

Music education dates back to the ancient civilizations, where it was recognized as crucial for human physical, spiritual, intellectual and moral development. During the Middle Ages, music was considered one of the seven liberal arts (Latin: *septem artes liberales*), studied alongside arithmetic, geometry, grammar, logic, rhetoric and astronomy. This presence of music in the educational and formative process continues to this day. Music encompasses both artistic-performative practice and scientific-theoretical thought. Today, music is studied at the highest level in higher education institutions as both an artistic and scientific discipline. In primary education, however, its primary goal remains “shaping the profile of a person: who thinks, listens, expresses themselves, creates and seeks beauty in life” (Ivanović, 2007, 5).

Musical literacy involves both entering into and constructing a musical whole, as well as understanding the mechanisms underlying the formulas that shape music into artistic communication (Miletić, 2018, 19). According to Vasiljević, Solfège originally represented purposefully written exercises for sight-singing using solmization syllables (Vasiljević, 2006). However, today, Solfège has evolved into a subject that encompasses various forms of work, such as dictation, melody, rhythm, music theory, intonation and perception, listening to music, and musical creativity, making it a multidisciplinary field. This multidisciplinary nature is reflected in the study of teaching disciplines and methods, with an emphasis on interdisciplinarity, aiming to introduce new, scientifically grounded methodological procedures. In modern didactics, successful teaching requires balancing four essential factors of the didactic quadrilateral: students, teaching goals and content, teachers, and teaching methods (Luteršek & Gazivoda, 2014). However, the teacher’s role is considered central to achieving the essence of the teaching process (Suzić, 2005). In addition to the forms of work mentioned above, the goal of Solfège instruction is to develop musical ear, musical memory, musicality, and foster an interest in music and the arts. These objectives suggest that literacy is a highly complex process, as “mastery of reading and writing enables students to practically use written language, and this skill functions to acquire new knowledge and abilities” (Nikolić, 1989, 21). For the educational process to be successful, the curriculum, students, and teachers must all play crucial roles. If a teacher is not committed to improving their quality, student motivation for learning a particular subject may be in vain. Additionally, the curriculum must meet the evolving needs of modern society. Developing the curriculum requires teamwork and the involvement of many stakeholders in the educational process: assessing the current state, removing outdated elements, and adding necessary and new components (Nagorni Petrov, 2016, 81). A quality curriculum is essential for the successful implementation of teaching and for supporting positive educational and formative outcomes.

Outcomes are vital in education for achieving quality knowledge among students. “Curricula are indicators of the state in society, the educational system within it, the importance given to the educational process at all levels of education, and the care for youth and their quality, well-designed present and future” (Nagorni Petrov, 2016, 83). “In didactic terms, the quality of knowledge is expressed at several levels: a) recall knowledge, b) recognition knowledge, c) reproduction knowledge, d) operational knowledge and e) creativity or creative knowledge as the highest level of knowledge quality” (Rajčević, 2016, 166). Students should master relevant content up to the level of operational knowledge (Pedagogical Encyclopedia, 1989). The educational and formative process follows the curriculum, which must be aligned with the needs of society. “The curriculum is a school document in which the subjects to be studied at a particular school are specified in tabular form, along with the sequence of studying these subjects by grade or semester and the weekly number of hours for each subject” (Rajčević, 2016, 164). In a rapidly changing society, where knowledge quickly becomes outdated and future needs are difficult to predict, it is necessary to adapt educational approaches to youth, which involves continually reforming the curriculum to address current societal challenges. Furthermore, it is understood that the teacher, as an interpreter of the curriculum, has the responsibility to “(...) continually improve the quality of their work” (Jespov, 1946, 3). Given the significance of Solfège instruction in preparing future teachers for primary and secondary music schools, who will impart competencies and foundational knowledge to new generations of students pursuing further studies at music faculties, it is crucial to examine the fundamental aspects of Solfège teaching. A review of the development of Solfège as a science offers insight into the understanding of the term throughout the long history of music study, from antiquity to the present day¹. By analyzing and systematizing elements and procedures from compositional music practice, Solfège has gained increasing importance among the sciences of music. Music literacy has become essential not only for mastering composition techniques and styles but also for achieving exceptional performance, developing a critical approach to music, and educating musicologists, ethnomusicologists, music theorists, music educators, and performers.

¹ The initial knowledge in the field of Solfège that students could acquire was available at several key institutions, including Milan Milovuk's Preparatory Music School (since 1854), the Government Music School for educating young men and familiarizing them with various styles of music, and the Government School of Singing for training church choir singers (since 1863). Other important institutions included are the Higher Music School – Conservatory, which offered the training in all instruments under the leadership of Teodor Toša Andrejević (since 1888), as well as various institutes, teacher training schools, and singing societies (Drobni 2008, according to: Pindović, 2022). In these music and educational institutions, Solfège instruction was not the primary focus; rather it served as tool for theoretical literacy and sight-singing, with the ultimate goal of achieving musical literacy. One reason Solfège was not the primary subject was the lack of dedicated textbook literature, which meant that Solfège teaching had to be conveyed orally. The first Solfège teachers gained their knowledge and skills at Western European conservatories, so it can be concluded that the foundation of Solfège education in Serbia was established based on Western European practices (Pindović, 2022). In this context, Ivana Drobni argues that “everyone would agree with the view that in the early days of Serbian music, it could not have been otherwise, that is, without following foreign models in the early 1870s” (2008, 19). However, Klajn suggests that there were disagreements regarding the application of Western European Solfège practices in Serbia, given that folk music is deeply embedded in the lives of people in the region (Đurić Klajn, 1981). One of the most significant turning points in Solfège instruction is associated with Borivoje Popović, who, in the early 1970s, played a pivot role in renaming the subject from “intonation” to “Solfège”. “His appointment as a head of the Department at the then Music Academy in Belgrade allowed him to “influence substantive changes that gave the subject a completely new dimension and significance” (Todorović, 2017, 190). During this period, various elements were merged, and the combined-functional method of Zorisava M. Vasiljević was established, which has been a foundational approach in music education in the Republic of Serbia for almost half a century (Vasiljević 2006: according to Pindović, 2022).

2. THE DEVELOPMENT AND USE OF MODERN TECHNOLOGIES IN SOLFÈGE INSTRUCTION

With the advancement of modern technologies, questions regarding when, how, and to what extent they can be implemented and integrated into teaching are becoming increasingly frequent. This issue extends to Solfège instruction as well. Modern technologies are defined as “a diverse set of technological tools and resources used for communication, creation, dissemination, storage, and management of information” (Tinio, 2003, 4). Milanovic and Novković Cvetković argue in their work that the introduction of modern technology into the teaching process is no longer merely a recommendation or idea, but a necessity. They assert that only teachers trained in applying modern technologies for educational purposes can effectively manage the teaching process (Milanovic, Novković Cvetković, 2020).

The development of technology has led to the creation of specialized software designed for music literacy, allowing it to be elevated to a higher level through digitization. The concept of information literacy has evolved alongside advancements in information and communication technology, making it a key competence within the modern educational frameworks of contemporary society (Strategija, 2012). Information literacy is crucial and requires specific skills to efficiently and effectively use computers to find, create, evaluate, and manage information.

Modern technologies in teaching offer a variety of applications, such as engaging learning games, educational programs, advanced communication systems, and online learning platforms. Božić notes that in the field of educational information technology, continuous development is aimed at creating social knowledge and fostering general education (Božić, 2014, 11).

The goal of Solfège instruction is to develop skills to the point of automation, which facilitates the mastery of new material through specific associations. According to Vasiljević, Solfège should serve as a means of understanding musical flows, as well as the comprehension, and interpretation of music (Vasiljević, 2006). He also emphasizes that “understanding the musical flow and its visual representation, familiarization with musical concepts and phenomena, acquaintance with musical styles, and correlating Solfège instruction content with vocal-instrumental and theoretical teaching” are all crucial elements of the instructional process (Vasiljević, 2006). The introduction of instructional technology into music education provides “various learning opportunities and helps students develop creative thinking, problem-solving, communication, and teamwork skills” (Dobrota, 2016, 4). Petrović highlights that the educational goals of Solfège instruction focus on aesthetically developing youth by instilling positive habits and motivating students to engage with high-quality, primarily artistic, music (Petrović, 1996). Thus, the aim of musical literacy should not be reduced to mere reproduction and memorization but should involve a deep understanding of musical phenomena and processes through active and conscious student participation (Golubović, 2011, as cited in Pavlović, 2018). Furthermore, musical literacy “entails the ‘entry’ into and construction of the musical whole and understanding the mechanisms underlying the formulas that shape music into artistic communication” (Miletić, 2018, 19). Musical literacy is defined as “mastery of reading and writing, enabling students to effectively use written language, which facilitates the further acquisition of new knowledge and skills” (Nikolić, 1989, 21). The process of music literacy education, which should be ensured through instruction, must address all aspects of music literacy, including mastering musical notation, developing auditory and vocal skills, and fostering musicality. Therefore, to ensure a high-quality music literacy education process, instruction should follow the sequence of sound – image – explanation (Vasiljević, 1991).

The digital revolution has expanded the concept of literacy, significantly increasing its potential for mass application in educational processes. Modern technologies “are of key importance at all levels of the education system. In each phase of cognitive activity, research, and practical application across all branches of knowledge, modern technologies serve both as tools and objects of knowledge. Consequently, innovations in modern technologies not only foster revolutionary development but also directly impact scientific and technological progress in all areas of society” (Milanovic, Novković Cvetković, 2020). However, the practical application of these technologies remains limited, primarily due to a lack of trained educational staff, necessary system reforms, and the insufficient digitization of the teaching process. Modern technologies help teachers in their preparation work by providing greater methodological diversity in teaching through meaningful use. Mia Nadrljanski emphasizes that “education through modern interactive media offers significantly higher quality compared to classical education methods. She positions modern media within the educational process and highlights their positive effects on learning. Digitalized information can be more easily edited with the support of images, animations, and sound, engaging multiple senses simultaneously to provide comprehensive information” (Nadrljanski et al., 2007, 528).

The application of digitization can significantly reduce the time between scientific discovery and practical implementation (Blažić, 2007). Glušac notes that strategic orientation is achieved through a series of innovations, which involve intentional changes in teaching aimed at enhancing its effectiveness, both as a whole and in specific areas of instruction (Glušac, 2005). The term “modernization” is often used to distinguish contemporary approaches from outdated ones. In the context of teaching, it implies “global and permanent improvements in the education and upbringing system or its 'subsystems,' including the modernization of staff, teaching techniques (such as using ICT as didactic teaching tools), and teaching technology” (Đorđević, Ničković, 1991, 322). Modern students expect teachers to be more engaged, creative, and employ teaching methods that enhances their interest while reducing passivity and declining motivation. However, “teachers are sometimes not interested in applying new teaching methods and prefer to stick with what they have been using for years—the traditional approach. Today, though, modern technologies offer a range of opportunities that can contribute to increasing teacher interest. There are teachers who have implemented modern technologies in their teaching, but not always in an adequate way” (Milanovic, Novkovic Cvetkovic, 2020). Therefore, it is necessary to modernize curricula and content, grounding them in the latest scientific discoveries. Establishing a connection between modern technology and contemporary content is crucial, as it directly impacts the implementation of teaching. Novković Cvetković notes that “digital transformation in education requires school principals and teachers to use digital technology to improve overall work. Leaders who wish to implement digital leadership should identify the best approach for their followers to ensure the effective participation of both teachers and students in the educational process” (Novković Cvetković et al., 2023, 193).

Based on the above, a key question arises: to what extent can modern technologies be applied in Solfège instruction and how? Modern technologies involve the use of information with computer processing, transmission of information through specific networks, and data searching, making them closely associated with computing. Pedagogy, as a science, has shown significant interest in information systems, as their characteristics could enhance student activity and creativity through the use of modernized didactic media.

Solfège instruction has functional-practical, educational, and formative goals, suggesting that it encompasses a broad concept of musical education and development. Its primary aim is to develop musical abilities so that “the human voice can produce a notated text and that the sound heard can be identified by consciousness” (Vasiljević, 2006), as well as fostering the development of musical thinking. A question arises regarding the functional-practical goals: do they refer only to singing examples and writing dictations? The answer can be found in the essence of the subject, which seeks to introduce certain exercises that lead to automation through specific associations, facilitating the mastery of the material. Such practice develops the quality and speed of reproducing musical examples. However, the fundamental goal of music literacy extends beyond simply singing examples and writing dictations. Just as reading and writing are not the sole goals of language teaching, the true purpose of Solfège is a “means for understanding musical flows and comprehending music” (Vasiljević, 2006). Golubović asserts that the goal of musical literacy should not be limited to memorization and reproduction, but rather involve a profound understanding of phenomena through active and conscious student participation (Golubović, 2011). The educational goals aim to motivate students and develop habits that foster an appreciation for quality artistic music. The formative goals, meanwhile, focus on “understanding the musical flow and its visual representation, familiarizing with musical concepts and phenomena, learning about musical styles, and correlating Solfège instruction content with vocal-instrumental and theoretical teaching” (Vasiljević, 2006).

3. METHODOLOGY

The subject of this research is the application of modern technologies in Solfège instruction, specifically focusing on the opinions of undergraduate and master's students regarding the use of modern technologies in the implementation of teaching content.

A key focus of this study is to understand the perspectives of undergraduate and master's students, as direct participants in the educational process, about the potential applications of modern technologies in Solfège instruction. Guided by a thematic framework that includes several key questions related to students' attitudes towards Solfège teaching, a questionnaire was designed to gather insights into students' interest and motivation for active participation in the learning process.

The goal of this research was to examine the opinions of students from all four years of undergraduate studies and master's students from the Music Pedagogy, Music Theory, and Performing Arts programs at the Faculty of Arts in Zvečan – Kosovska Mitrovica, University of Priština, and the Faculty of Arts in Niš, University of Niš, regarding Solfège instruction and the extent to which modern technologies are integrated into the teaching content. To achieve this goal, the following tasks were set:

- To determine students' opinions on the importance of using modern technologies in Solfège instruction.
- To assess students' opinions on the competence of professors and teaching assistants in utilizing modern technologies in instruction.
- To identify the areas within Solfège where modern technologies are most frequently applied.

- To determine which teaching tools and aids are most commonly used in Solfège instruction.
- To explore whether students believe that modern technologies have helped them master the teaching content.
- To evaluate whether the use of modern technologies in teaching can enhance creativity among professors and teaching assistants.

The aim of this research is to gain a deeper understanding of the issues related to the implementation of Solfège instruction at higher education institutions, as well as to identify the need for improving student motivation, the quality of preparation, and the delivery of teaching through the use of modern educational tools. In line with the stated goal and the method of implementation, this research can be categorized as exploratory (due to the under-researched methodological area), empirical (as it tests certain theoretical propositions in practice), diagnostic (as it aims to provide insights into the current state concerning the chosen problem), and descriptive (since data collection was conducted through a survey).

The research was carried out during the winter semester of 2023/24. Data were collected through anonymous surveys distributed to students via the Google Forms platform. The data were then processed using the IBM SPSS Statistics software (version 26), with significance levels of 0.1 and 0.05, depending on the sample. The results will be presented using both descriptive and non-parametric statistics.

Based on the defined goals and research problems, the following hypotheses were formulated:

- Students have a positive opinion about the use of modern technologies in Solfège instruction.
- Students evaluate the competence of professors and teaching assistants in using modern technologies in Solfège instruction as adequate.
- Professors and teaching assistants use modern technologies sufficiently, mostly in the area of dictation.
- Professors and teaching assistants most commonly use computers and instruments in Solfège instruction.
- Students believe that modern technologies have helped them master the teaching content.
- The use of modern technologies in teaching can enhance creativity among professors and teaching assistants.

The research involved 90 students, with 46 (51.1%) from the Faculty of Arts in Zvečan – Kosovska Mitrovica and 44 (48.9%) from the Faculty of Arts in Niš (see Table 1). The surveyed students were enrolled in the following programs: Performing Arts – 31 (34.5%), Music Pedagogy – 32 (35.5%), and Music Theory – 27 (30.0%) (see Table 2). At the Faculty of Arts in Niš, 27 (30.0%) of the surveyed students were in the Music Theory program, while the remaining 17 (18.9%) were in the Performing Arts program (see Table 3). All surveyed students in the Music Pedagogy program, 32 (35.5%), study at the Faculty of Arts in Zvečan – Kosovska Mitrovica, while the remaining 14 (15.6%) students at the same faculty are enrolled in the Performing Arts program (see Table 4).

Table 1 Number of students per faculty

Faculty	Student number	Percentage (%)
Faculty of Arts in Zvečan – Kosovska Mitrovica	46	51.1
Faculty of Arts in Niš	44	48.9
Total	90	100.0

Table 2 Number of Students by Study Program

Study Program	Number of Students	Percentage (%)
Music Pedagogy	32	35.5
Music Theory	27	30.0
Performing Arts	31	34.5
Total	90	100.0

Table 3 Number of Students by Study Program at the Faculty of Arts in Niš

Study Program	Number of Students	Percentage (%)
Music Theory	27	30.0
Performing Arts	17	18.9
Total	44	48.9

Table 4 Number of Students by Study Program at the Faculty of Arts in Zvečan – Kosovska Mitrovica

Study Program	Number of Students	Percentage (%)
Music Pedagogy	32	35.5
Performing Arts	14	15.6
Total	46	51.1

Out of the 90 participants, 37 (41.1%) are enrolled in master's studies, while the remaining 57 are undergraduate students. These undergraduate students are categorized by year as follows: 1 (1.1%) first-year student, 3 (3.3%) second-year students, 20 (22.2%) third-year students, and 29 (32.2%) fourth-year students (see Table 5).

Table 5 Number of Students by Study year

Study year	Number of Students	Percentage (%)
First year	1	1.1
Second year	3	3.3
Third year	20	22.2
Fourth year	29	32.2
Master studies	37	41.1
Total	90	100.0

Overall, the gender distribution among participants is relatively balanced, with 36 (40.0%) male students and 54 (60.0%) female students (see Table 6). At the Faculty of Arts in Niš, female students (75.05%) are more represented compared to male students (24.95%) (see Table 7), whereas at the Faculty of Arts in Zvečan – Kosovska Mitrovica, the situation is different, with 66.7% male students and 33.4% female students participating in the research (see Table 8).

Table 6 Gender distribution by Year of Study

Gender	Year of Study					Total
	First Year	Second Year	Third Year	Fourth Year	Master studies	
Male	0	0	10	9	17	36
Female	1	3	10	20	20	54
Total	1	3	20	29	37	90

Table 7 Gender of Students at the Faculty of Arts in Niš

Gender	Number of Students	Percentage (%)
Male	11	12.2
Female	33	36.7
Total	44	48.9

Table 8 Gender of Students at the Faculty of Arts in Zvečan – Kosovska Mitrovica

Gender	Number of Students	Percentage (%)
Male	25	27.8
Female	21	23.3
Total	46	51.1

The data on the gender of respondents and their year of study offer a closer look into the structure of the research sample. The number of surveyed students increases in higher years of undergraduate studies, with the highest number found in master's. Notably, no male students from the first or second year of undergraduate studies participated in the research. Four female students from the first and second year of undergraduate studies are enrolled at the Faculty of Arts in Niš (Table 1).

Statistical analysis revealed gender differences among fourthyear undergraduate and master's students at the Faculty of Arts in Niš, which were statistically significant ($\chi^2=5.016$, $df=4$, $p=0.285$). However, gender differences in the sample from the Faculty of Arts in Zvečan – Kosovska Mitrovica were not statistically significant. Analyzing the sample structure, it can be concluded that there is an approximately equal distribution of respondents based on faculty, study program, year of study, and gender.

4. RESULTS AND DISCUSSION

4.1 Importance of Using Modern Technologies in Solfège Instruction

The first task of the research was to determine students' opinions on the importance of using modern technologies in Solfège instruction. The goal was to understand their views on the application of modern technologies in Solfège teaching. The results indicate that most students consider it important to use modern technologies in the teaching process: 60 (66.7%) students answered "strongly agree", and 17 students (18.9%) answered "agree". Thirteen respondents (14.4%) believe that using modern technologies in the teaching process is not significant.

Cross-tabulating the first question with students' gender at the Faculty of Arts in Niš revealed statistical significance ($\chi^2=12.593$, $df=2$, $p=0.001$). Male students generally agree

with the statement about the importance of using modern technologies in Solfège instruction, while female students, to some extent, believe that their use is not significant.

Analyzing the data from the first research task, it is evident that most respondents have a positive opinion about the use of modern technologies in Solfège instruction. Most agree with statements describing the positive impact of such technologies on improving teaching quality, increasing student motivation for work and learning, making lessons more engaging, facilitating understanding of content, accelerating knowledge acquisition, and enhancing the dynamics of teaching.

Based on this analysis, we can conclude that the first hypothesis - "Students have a positive opinion about the use of modern technologies in Solfège instruction" - has been confirmed (Table 9).

Table 9 The Importance of Modern Technologies in the Teaching Process of Solfège

Response	Number of Students	Percentage (%)
Strongly Agree	60	66.7
Agree	17	18.9
Not Significant	13	14.4
Total	90	100.0

4.2. Evaluation of the Level of Knowledge Required for Using Modern Technologies

The second research task focused on assessing students' views regarding the competence of professors and teaching assistants in using modern technologies in teaching. Forty students (44.4%) from both faculties believe that professors and teaching assistants are very well equipped to use modern technologies in the teaching process; 28 students (31.1%) consider them adequately equipped, while 13 students (14.4%) believe they are not sufficiently equipped (Table 10).

Table 10 Professors and Assistants Are Adequately Trained in Using Modern Technologies in Teaching

Response	Number of Students	Percentage (%)
Very Well	40	44.4
Adequately	28	31.1
Not at All	22	24.4
Total	90	100.0

Although most students are satisfied with the competence of professors and teaching assistants in using modern technologies, differences in responses were observed among students of different ages. Younger students (first and second year) expressed more dissatisfaction with the competence of professors and teaching assistants, indicating dissatisfaction compared to their older peers. The results ($\chi^2=17.534$, $df=8$, $p=0.025$) suggest a need for improvements in teaching practices to enhance skills and broaden knowledge in the application of modern technologies.

Analyzing the data obtained from the second research task, we conclude that students largely perceive professors and teaching assistants at both faculties as well-equipped to use modern technologies in Solfège instruction. However, a smaller percentage of students believe that further professional development is needed. Based on this analysis, we can

confirm the second hypothesis, which states: “The competence of professors and teaching assistants in using modern technologies in teaching is satisfactory”.

4.3. Identifying Which Areas and How Often Modern Technologies Are Used in Solfège

The third research task aimed to identify the areas in which professors and teaching assistants most frequently apply modern technologies in Solfège instruction. Data analysis indicates that more than half of the respondents, 54 students (60%), believe that modern technologies are most commonly used in the area of dictation (including ear training exercises, intervals, tuning, dictation and harmonic connections). A quarter of the students, 21 (23.3%), believe these technologies are most frequently applied in the area of melody, while 15 (16.7%) students think that modern technologies are not sufficiently applied in any area. Notably, no respondent reported the use of modern technologies in the area of rhythm (Table 11).

Table 11 In Which Area Modern Technologies Are Most Frequently Applied

Response	Number of Students	Percentage (%)
Dictation Area	54	60.0
Melodic Area	21	23.3
Rhythm Area	0	0.0
Not Applied	15	16.7
Total	90	100.0

The second question in this task addressed whether modern technologies are frequently used in every class during the teaching process. An interesting finding is that students from both faculties expressed dissatisfaction with the frequency of technology use. More than half of the respondents indicated that modern technologies are not frequently used; 34 students (37.8%) reported that they are used in fewer than two classes per semester, 26 (28.9%) stated they are used in three classes per semester, while only 30 students (33.3%) believe that modern technologies are used very frequently in teaching (Table 12).

Table 12 Application of Modern Technology in Teaching

Response	Number of Students	Percentage (%)
Less than two classes per semester	34	37.8
Three classes per semester	26	28.9
Almost every class per semester	30	33.3
Total	90	100.0

Cross-tabulation of these results with the students' years of study revealed that fourth-year undergraduate and master's students believe modern technologies are not frequently used in the teaching process. In contrast, first, second, and third-year undergraduate students generally believe that these technologies are used in approximately three classes per semester. The statistical significance ($\chi^2=17.534$, $df=8$, $p=0.025$) may suggest some variability in the use of modern technologies across different years of study, possibly reflecting an increase in their application over time or differing expectations among student cohorts.

Based on the analysis of data from the third research task, we conclude that most respondents believe modern technologies are not used frequently in Solfège instruction, though they are most commonly applied in the area of dictation. Therefore, the third hypothesis - “Professors and teaching assistants use modern technologies sufficiently, mostly in the area of dictation” – can be considered partially confirmed.

4.4. Determining the Most Commonly Used Teaching Tools and Resources in Solfège Instruction and Whether Faculties Are Adequately Equipped with Modern Resources

The fourth research task aimed to determine which teaching tools and resources are most frequently used in Solfège instruction and whether the faculties are adequately equipped with modern teaching technologies. The goal was to gather students' opinions on the availability of resources, such as interactive whiteboards, computers (desktop/laptop), video projectors, musical instruments, internet, access and whiteboards with a staff system. Data analysis reveals that 68 students (75.5%) from both faculties believe that their institutions are excellently equipped with modern teaching resources. In contrast, 11 students (12.2%) consider the equipment to be modest, and another 11 believe it is insufficient (Table 13).

Table 13 Faculty Equipped with Modern Teaching Tools

Response	Number of Students	Percentage (%)
Faculties are excellently equipped with modern teaching tools	68	75.5
Faculties are modestly equipped with modern teaching tools	11	12.2
Faculties are not sufficiently equipped with modern teaching tools	11	12.2
Total	90	100.0

In response to question regarding which of the listed teaching tools are most frequently used in instruction, a total of 160 responses were recorded (as each respondent could select up to two options). The majority of students, 45 (50%), indicated that instruments (electric piano/pianino/ grand piano) are most frequently used by professors and teaching assistants. Thirty-four students (37.8%) identified computers (desktop/laptop) in combination with interactive whiteboards as commonly used tools. Additionally, non-parametric analysis revealed that 24 students specifically associated the use of computers with the EarMaster software. Eleven students (12.2%) stated that video projectors are used. Notably, there were no responses indicating that none of the listed tools are used.

Although most students reported satisfaction with the available equipment, a statistically significance difference was found among students of different academic years ($\chi^2=22.901$, $df=8$, $p=0.003$). Younger students (first and second year) expressed lower level of satisfaction compared to their older peers.

Based on the analysis, we can conclude that students at both faculties consider their institutions to be well-equipped with modern teaching resources. Therefore, the fourth hypothesis - “Professors and teaching assistants most frequently use instruments, computers, and projectors in Solfège instruction” - has been confirmed.

4.5. Examining Students' Opinions on Whether Modern Technologies Have Helped Them Master the Curriculum

The fifth research task aimed to determine whether modern technologies have assisted students in mastering the curriculum as prescribed by the syllabus. Data analysis shows that more than half of the respondents, 61 students (67.8%), believe that modern technologies have helped them master the material and made it easier to acquire knowledge. Twenty-seven students (18.9%) stated that while modern technologies did help them master the content, they did not significantly facilitate the learning process. Meanwhile, 12 students (13.3%) reported that modern technologies did not help them at all (Table 14).

Table 14 Modern Technologies Assist in Mastering the Curriculum

Response	Number of Students	Percentage (%)
Assist and Facilitate the Learning Process	61	67.8
Assist but Do Not Facilitate the Learning Process	27	18.9
Do Not Assist	12	13.3
Total	90	100.0

Cross-tabulation of this question with students' gender and year of study revealed statistical significance ($\chi^2=14.586$, $df=4$, $p=0.006$). Specifically, male students indicated that modern technologies have helped them master the material but did not necessarily ease the learning process.

Based on the analysis, we can conclude that most students believe the use of modern technologies in the teaching process has assisted in mastering the material and facilitated knowledge acquisition. Therefore, the fifth hypothesis - "Modern technologies help in mastering the curriculum" - has been confirmed.

4.6. Examining Students' Opinions on Whether Modern Technologies and Their Application in Teaching Can Enhance Creativity in Professors and Teaching Assistants

The sixth research task aimed to determine whether the application of modern technologies in teaching can enhance creativity in professors and teaching assistants. Data analysis reveals that 70 students (77.6%) from both faculties believe that more frequent use of modern technologies in teaching can enhance creativity in professors and teaching assistants (Table 15).

Table 15 Professors and Assistants Have Enhanced Knowledge and Creativity Through the Use of Modern Technology in the Teaching Process

Response	Number of Students	Percentage (%)
Enhanced	71	78.9
Not Enhanced	19	21.1
Total	90	100.0

Non-parametric analysis indicated that professors and teaching assistants have significantly improved their digital literacy. However, 20 students (22.2%) believe that professors and teaching assistants cannot enhance their creativity through the application of modern technologies in teaching.

Cross-tabulation of this question with students' year of study and gender revealed statistical significance ($\chi^2=14.388$, $df=8$, $p=0.072$). Female students in their fourth year of undergraduate studies at both faculties expressed the opinion that professors have not sufficiently enhanced their knowledge and creativity through the use of modern technologies. Despite this, these students still considered modern technologies to be very important for the teaching process.

Based on the analysis, we can conclude that most students believe that the application of modern technologies in teaching can enhance creativity in professors and teaching assistants, and that these educators have significantly improved their digital literacy over time. Therefore, the sixth hypothesis - "Modern technologies and their application in teaching can enhance creativity in professors and teaching assistants" - has been confirmed.

5. CONCLUSION

Based on the finding above, we can conclude that the hypotheses have been proven: students have a positive opinion about the application of modern technologies in teaching and report positive experiences with the benefits of using multimedia content. Students from the Music Pedagogy and Performing Arts programs at the Faculty of Arts in Zvečan – Kosovska Mitrovica, University of Pristina, and Music Theory and Performing Arts at the Faculty of Arts in Niš, University of Niš, generally believe that professors and teaching assistants do not use modern technologies frequently, but they do use them adequately in delivering teaching content.

Students also believe that presenting material through a combination of text, graphics, video, and sound helps professors deliver the syllabus more effectively. Furthermore, they feel that professors are adequately trained to use modern resources in the teaching process and that their faculties are well-equipped with the necessary resources for this purpose.

The application of modern resources in teaching enhances creativity among professors and increases student engagement, as it revitalizes the daily teaching routine and fosters a more pleasant classroom atmosphere. For students, digital information represents a familiar mode of communication, reflective of their everyday experiences. However, the key to high-quality teaching is the preparation of teaching materials, methodological approach, and the organization of presentations. Therefore, it must be emphasized that the ultimate quality and success of individual and collective educational outcomes depend on the creativity and commitment of professors. It is crucial to cultivate awareness about the extensive use of modern technologies in the implementation of teaching content, as these technologies should complement and enhance the overall teaching process.

REFERENCES

- Blažić, M. (2007). *Obrazovna tehnologija*. Vranje: Pedagoški fakultet
- Božić, V. Snjeguljica. (2014). *Internet i multimedija kao alati u nastavi književnosti (doktorska disertacija)*. Niš: Univerzitet u Nišu: Filozofski fakultet.
- Dragičević Šešić, M. i Stojković, B. (2007). *Kultura. Menadžment. Animacija. Marketing*. Beograd: Clio.
- Drobni, I. (2008). *Metodičke osnove vokalno-instrumentalne nastave*. Beograd: Zavod za udžbenike
- Dobrota, S. (2016). *Glazbena nastava u nastavna tehnologija*. U N. Mihaljević (ured.). *Zbornik radova Filozofskog fakulteta u Splitu*, 6-7, (6 – 23). Split: Filozofski fakultet.
- Djordjević, M., Ničković, R. (1991). *Pedagogija*. Niš: Prosveta.
- Djuric Klein, S. (1954). *Muzika I muzičari*. Beograd: Prosveta.
- Golubović, D. (2011). *Savremene metode obrazovanja i tehnologije i informatike za društvo učenja i znanja. Tehnologija, informatika i obrazovanje za društvo učenja i znanja*. Čačak: Zbornik radova: VI Međunarodni simpozijum.
- Glušac, D. (2005). *Metodičko-didaktička pitanja efikasnosti nastave informatike*. Zrenjanin: Tehnički fakultet "Mihajlo Pupin". Univerzitet u Novom Sadu.
- Ivanović, N. (2007a). *Metodika opšteg muzičkog obrazovanja za osnovnu školu*. Beograd: Zavod za udžbenike.
- Luteršek, N. i Gazivoda, N. (2014). *Obrazovanje i nastava. Pedagoško-psihološki aspekti nastave*. Podgorica: Zavod za školstvo.
- Milanović, A., Novković Cvetković, B. (2020). *ICT in teaching – once a choice, now a necessity*. Niš: Facta Universitatis, Vol. 4, No 2, pp. 147 – 156.
- Miletić, A. (2018). *Od folklornih tonskih osnova do dur-mol sistema u nastavi muzičkog opismenjavanja*. Beograd: Pedagoški fakultet.
- Nikolić, M. (1989). *Metodika nastave maternjeg jezika i pismenosti*, Beograd: Zavod za udžbenike i nastavna sredstva.
- Novković Cvetković, B., Spasić Stojić, A., Tasić Mitic, I. (2023). *Leadership in education in the digital age*. Niš: Facta Universitatis, vol. 7, No1, pp. 189 – 199.
- Nadrljanski, M., Nadrljanski, Đ. i Bilić, M. (2007). *Digitalni mediji u obrazovanju*. U: S. Sejan i H. Stančić (ured.), *INFuture2007: Digital Information and Heritage* Zagreb: Odsek za informacijske znanosti i Filozofski fakultet, 527–537.
- Nagorni Petrov, N. (2016). *Inovativni pristupi u nastavi harmonije kao deo reforme u srednjem i visokom muzičkom vaspitanju i obrazovanju. (Doktorska disertacija)* Niš: Filozofski fakultet. <https://fedorani.ni.ac.rs/fedora/get/o:1145/bdef:Content/download>
- Pindović, B. (2022). *Dijahronijski presek razvoja nastave solfeđa u Republici Srbiji*. Priština-Leposavić: Baština, St.57.
- Pavlović, S. (2018). *Mogućnosti primene informaciono-komunikacione tehnologije u nastavi muzičkog opismenjavanja (odbranjena doktorska disertacija)*. Banja Luka: Akademija umjetnosti.
- Petrović, S. (1996). *Estetika*. Beograd: Čigoja štampa.
- Rajčević, P. (2016). *Nastavni plan i program za osnovnu školu i društveno-gospodarski sustav*. U: S. Minić, (ur.), *Zbornik radova Pedagoškog fakulteta, Prizren - Leposavić*, (str. 163–174). Leposavić: Sveučilište u Prištini, Pedagoški fakultet.
- Strategija (2012). *Strategija razvoja obrazovanja u Republici Srbiji do 2020*. Beograd: Vlada Republike Srbije.
- Suzić, N. (2005). *Pedagogija za XXI vijek*, Banja Luka: TT-Centar.
- Tinio, L. V. (2003). *E-Primers for the information economy, society and polity. ICT in Education*. e-ASEAN Task Force.
- Todorović, D. (2017). *„Katedra za solfeđa i muzičku pedagogiju“. 80 godina Fakulteta muzičke umetnosti (Muzičke akademije)*. ur. Ivana Perković. Beograd: Fakultet muzičke umjetnosti, 188–195
- Vasiljević, Z.M. (2006). *Metodika muzičke pismenosti*. Beograd: Zavod za udžbenike i nastavna sredstva.
- Vasiljević, Z. (1991). *Metodika solfeđa*. Beograd: Fakultet muzičke umetnosti.

UTICAJ SAVREMENIH TEHNOLOGIJA NA RAZVOJ MUZIČKIH SPOSOBNOSTI I KREATIVNOSTI NA VISOKOŠKOLSKIM USTANOVAMA

Posmatrajući razvoj muzičke pedagogije kao nauke, u savremenom dobu bez upotrebe savremene tehnologije teško je zamisliti nastavni proces. Prisustvo pametnih telefona, tablet-računara i pomoćnih pomagala u realizaciji nastave solfeđa, poput pametne table, audio CD plejera, projektora, MIDI kontrolera, klavijatura, u današnje vreme predstavlja jedno od najznačajnijih dostignuća za kvalitetnu realizaciju nastave. U okviru ovog rada, prezentovani su rezultati istraživanja sprovedenog u cilju provere korišćenja pametnih uređaja u realizaciji nastavnih sadržaja na predmetu solfeđo. Na osnovu toga, izvršena je analiza reprezentativnog uzorka kroz kvalitativno i kvantitativno istraživanje, gde dobijeni rezultati ukazuju na nedostatke i benefite koje savremena digitalna nastavna sredstva nude. Istraživanjem je utvrđeno da studenti imaju pozitivno mišljenje o korišćenju savremenih tehnologija u nastavi solfeđa, o osposobljenosti profesora i asistenata u korišćenju savremenih tehnologija i da većina studenata smatra da korišćenje savremenih tehnologija u nastavi može unaprijediti kreativnost kod profesora i asistenata u nastavi.

Ključne reči: solfeđo, teorija muzike, savremene tehnologije, pedagogija, pismenost, muzička sposobnost i kreativnost.