Katarina Zadnik, PhD, Sara Smrekar

Incorporating Digital Technology in Music Theory and Solfeggio Courses

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POVZETEK – Prispevek se osredotoča na prisotnost in uporabo digitalnih tehnologij pri poučevanju predmetov glasbena teorija in solfeggio v glasbenih šolah. Preučevali smo, kako digitalna orodja podpirajo izvajanje temeljnih glasbenih dejavnosti ter kako jih učitelji vključujejo v učni proces. S pomočjo polstrukturiranih intervjujev, izvedenih s šestimi učitelji iz različnih slovenskih regij, ki predstavljajo naš vzorec, smo izvedli kvalitativno raziskavo, utemeljeno na tematski analizi z induktivnim pristopom. Ugotovitve so pokazale, da se digitalne tehnologije redko uporabljajo za podporo glasbenim dejavnostim; pogosteje se uporabljajo pri dejavnostih poslušanja in predstavitvi učne vsebine. Pri doseganju učnih ciljev prevladujejo kombinirani in tradicionalni pristopi, novih glasbenih dejavnosti, ki bi bile možne le z uporabo digitalnih orodij, pa učitelji niso razvili. Razlogi za omejeno uporabo digitalnih orodij po njihovem izhajajo iz pomembnosti aktivne vloge učencev pri pouku ter njihovega fizičnega doživljanja in občutenja glasbene vsebine. Kljub temu pa učitelji pojem "digitalna tehnologija" razumejo kot skupek orodij, ki so danes nepogrešljiva in jih je treba vključiti v učni proces.

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ABSTRACT – The paper focuses on the presence and use of digital technologies to teach the subjects of music theory and Solfeggio in music schools. We examined how digital tools support implementing fundamental musical activities and how teachers incorporate them into the teaching process. Through semi-structured interviews conducted with a sample of six teachers from various Slovenian regions, we carried out a qualitative study based on thematic analysis using an inductive approach. The findings revealed that digital technologies are rarely used to support musical activities, and instead are most commonly used for listening activities and presenting teaching content. Combined and traditional approaches are dominant in achieving learning goals, while new musical activities that would not be possible to implement without digital tools have not been developed. The teachers' arguments for the limited use of digital tools stem from the importance of the students' adopting an active role in class, experiencing and feeling musical content on a physical level. However, the teachers understood the term digital technology as referring to a number of tools that are now indispensable and must be integrated in the learning process.

1 Introduction

The need to promote a greater development of digital competences has emerged most prominently during and after the COVID-19 epidemic (Blanco-García et al., 2025), and in Slovenia, with the current transition to the so-called Smart Society 5.0, an ecosystem of artificial intelligence and new technologies (Vlada RS [Government of the RS], 2023). Moreover, in the field of education, there are calls to transform teaching strategies and complement and upgrade digital competences in line with the technological developments and challenges of the 21st century (Caena & Redecker, 2019; OECD, 2019). The use of digital technologies in the learning process is influenced by both the

development of digital competences (Henessy et al., 2022) and several other factors (Fransson & Lindberg, 2018; Mateos-Moreno & Bravo-Fuentes, 2023). For example, research has shown (Chen, 2012; Hennessy et al., 2005; Lawrence & Tar, 2018; Rotar Pance & Bohak Adam, 2019) that teachers' attitudes and positive beliefs about how well digital tools will support the learning process and meet their learning expectations are one of the more important factors in the use of these. Drožđek et al. (2019) state that in order to achieve a successful integration of digital tools into the learning process, it is important for the teacher to recognize and implement their use in a meaningful manner, which will support the focal educational goals (Lawrence & Tar, 2018; Wise et al., 2011). Research also shows (Colás-Bravoa & Hernández-Portero, 2023; Kranjc et al., 2020; Lawrence & Tar, 2018; Willis et al., 2018) that teachers with better developed digital skills are in a better position to assess the usefulness of integrating digital tools into the learning process. Fernández-Batanero et al. (2020) analysed 21 qualitative studies in the field of teachers' digital literacy, and found that the results revealed insufficient training for the appropriate use of this technology. Bohak Adam (2024) notes that most European countries are implementing initiatives to improve digital competences and integrate such technologies into pedagogical practice. However, the challenge of providing equal access to training and support for all teachers remains an obstacle to the success of these efforts (Bohak Adam, 2024; Mičija Palić, 2022). Although Slovenia has been allocating financial resources to the development of the digital competences of teachers and students since 1993, the results of a European survey (Mentoring Technology Enhanced Pedagogy, 2017/18, in Šimunovič, 2020) showed that the digital competences of Slovenian teachers, compared to teachers in other European countries, are in fact declining (Flogie & Aberšek, 2019).

Slovenian music education, which is regulated by law (Music Schools Act, 2000, 2006, 2024), includes several music programmes: pre-school music education, music preparation and music programme, with compulsory instrumental/singing lessons and the subjects of music theory (lower level, six years) and Solfeggio (higher level, two years). Unlike instrumental instruction, the latter courses emphasize group learning (MIZŠ, 2022a, 2022b). In this paper, we focus on the presence and use of digital tools in the group courses of music theory (MT) and Solfeggio. The basic goal of both courses is to develop functional music literacy as a basic competence, which is manifested in the ability to use musical notation as a fundamental element in musical (re)creation. The target and developmental orientation of the subjects is achieved in active learning forms, based on basic musical activities. The practice of *solfeggio* is a cornerstone in the development of functional music literacy. The *implementation and interpretation of examples from the musical literature* deepens both musical performances and knowledge, and develops musical literacy through the experience of examples from musical literature and cross-curricular connections. The *listening* activity that is part of this promotes the development of analytical listening skills in relation to musical elements. In the related *creating* activity, the development of musical literacy is supported by writing the musical content that is created in standard notation. The musical abilities, skills and knowledge acquired through these basic activities enable the development of both *music-theoretical and formal knowledge* (Zadnik, 2019).

In the field of digital competences in music education, Valant (2016) found a decade ago, in a study with a sample of 110 teachers in music schools, that the respondents

most often used videos to listen to musical performances (93 %), applications with a metronome to maintain the tempo (51 %), and digital tools to record musical performances in the learning process (49 %). The COVID-19 epidemic that began in early 2020 necessitated the use of digital tools as the only possible form of teaching and distance learning in synchronous and asynchronous formats (Blanco-García et al., 2025; Gerlič, 2013). Šimunovič (2020) found that this transition to distance learning had a positive impact on raising digital competencies in both teachers and students, although the instrument teachers surveyed saw remote work as enabling a lower-quality form of teaching. Zadnik (2021) found that few teachers applied innovative didactic approaches using digital tools during the COVID lockdowns, and traditional approaches similar to the classical way of teaching in the classroom prevailed. Recent research shows considerable inconsistencies in the use of digital tools in music education, with the data usually obtained through case studies. Similar to Marovič et al. (2025), who identified the positive effects of flipped learning based on an analysis of a synthesis of the existing literature and found that "students become active, participatory members of the learning process as they have more responsibility for their own progress" (Marovič et al., 2025, p. 15); Suljić & Miklič (2024) found in a pilot study for the subjects of MT and Solfeggio that a combined type of teaching using video lessons for homework had positive effects on the understanding of music theory, as well as on the concentration and attention of students. Kramar et al. (2024), as part of a case study, found positive effects of the use of visual, audio, and audio-visual aids on the sight-reading of sheet music in instrument lessons, MT and Solfeggio. However, there is currently a lack of research on the use of digital technologies in MT and Solfeggio courses, and this was the impetus for conducting the research reported here.

We were interested in how digital tools support the implementation of five activities: *solfeggio*, *implementation and interpretation of examples from the musical literature*, *listening*, *creating*, *music-theoretical and formal knowledge*. We wanted to find out how teachers of these subjects use digital tools and how they interpret the term *digital technology*, based on the following research questions:

- RQ1: How do MT and Solfeggio teachers understand the term *digital technology*?
- RQ2: How do MT and Solfeggio teachers use digital tools in the implementation of core music activities?

2 Methodology

We applied a qualitative approach using thematic analysis (Braun & Clarke, 2012). The theoretical explanation of the current, regular use of digital technology in MT and Solfeggio courses was derived by an iterative process of data collection and inductive analysis of the data obtained.

Participants

We used a non-random sampling method, with the inclusion criterion of teachers teaching MT and Solfeggio as group subjects in a music school. Six teachers (N = 6) from different regions of Slovenia agreed to participate: Osrednjeslovenska (1), Gorenjska (1), Goriška (1), Savinjska (2), and Jugovzhodna Slovenija (1). They had the following qualifications: Master Professor of Music according to the Bologna System (N = 2) and Professor of Music before the Bologna System (N = 4). The mean length of service of the sample teachers was 18.5 years ($\bar{x}$ = 18.5): two years (N = 1), five years (N = 1), 10 years (N = 1), 25 years (N = 1), 32 years (N = 1), 37 years (N = 1).

Data collection process

We designed a semi-structured interview to obtain information about years of service, the concept of digital technology, classroom equipment, and the use of digital technology in the implementation of music activities in the MT and Solfeggio classes. The resulting interviews, which lasted from 20 to 40 minutes remotely (on the Zoom application) followed a relatively free and open structure that allowed for the discovery of topics, and were conducted in December 2024. The interviews were recorded and transcribed verbatim with the permission of the participants, and then translated into English by the author.

Data analysis process

The transcripts were manually processed according to a coding process, using a method of identifying meaningful topics in relation to research questions (Braun & Clarke, 2012), which we modified by combining codes into (sub)categories and topics. We used pseudonymization to protect the data. In the process of collecting and analysing data, the participant was given an anonymous research code:

- *T.I_osr.* (teacher 1 from Osrednjeslovenska),
- *T.II_gorenjska* (teacher 2 from Gorenjska),
- *T.III_goriška* (teacher 3 from Goriška),
- *T.IV_JVS* (teacher 4 from Jugovzhodna Slovenija),
- *T.V_sav.1* (teacher 5 from Savinjska) and
- *T.VI_sav.2* (teacher 6 from Savinjska).

We labelled the participant statements with sequential numbers (*I1, I2, etc.*) and added them to the participants' codes. The Commission for Research Ethics of the University of Ljubljana (*Komisija za etiko v raziskavah Univerze v Ljubljani – KERL UL*) confirmed that this research met its ethical criteria and standards.

3 Results

Teacher's understanding of digital technologies

The participants initially reported on their understanding of the concept of digital technology. Thus, within the theme of *Digital Technology*, the following categories were highlighted: *understanding of digital technology in general, specific understanding of digital technology, and digitally supported learning spaces*.

The category of *understanding of digital technology in general* highlighted the feature of technology as an indispensable tool in everyday life, as seen in the following quotes:

"*These are technical gadgets to make everyday tasks easier: phone, computer, tablets. They are essential for how I structure my day." (T.I_osr_I1)*

"*I use technology because that's what we have to do." (T.III_goriška_I1)*

Comments on the use of digital technology in private life were closely intertwined with the category of the s*pecific understanding of digital technology* in the context of the professional activity of the participants. They reported on the use of digital devices (smart whiteboard, phone, camera, speakers, computer, projector), software (PowerPoint), file formats (pdf), various applications (Metronome, Tuner, music creation applications) and platforms (e-music school, YouTube, Music Theory, Spotify, Kahoot). Teachers understand the concept of digital technologies similarly to the definition used in the European Framework of Digital Competences of Educators: "*Any product or service that can be used for the electronic production, viewing, sharing, reproduction, storage, retrieval, transmission and reception of information in digital form.*" (Redecker, 2017, p. 88).

We found that the teacher's specific understanding of digital technology is particularly related to the digital equipment used in classrooms. Under the category digitally supported learning spaces, three subcategories were highlighted: *standard digitally equipped classroom, interactive classroom*, and *technology-supported hall*.

Five participants reported that their home classrooms were standard digitally equipped ones, with a computer, projector, and music system, and only one participant reported that their home classroom was also equipped with a smart whiteboard:

"*My classroom has a projector, a smart whiteboard, a computer, a music system, as well as a photocopier." (T.V_sav.1_I6).*

"*We basically have computers in all classrooms." (T.VI_sav.2_I4)*

"*We have two classrooms and one has a smart whiteboard, one doesn't." (T.I_osr_I5)*

"*I don't have a smart whiteboard, I just have a screen, a projector with a computer, a laptop, a music system." (T.IV_JVS_I7)*

We did not ask a question about technology-supported halls, but one participant noted that their school had one of these (category *digitally supported learning spaces*):

"*We have recording devices in the hall, the lighting is new. We also have a projector for some conferences." (T.VI_sav.2_I4)*

Overall, the teachers' statements indicate access to high-quality digitally equipped primary learning spaces (home classrooms) and secondary learning spaces (halls). These positive results led us to study the use of these tools in the learning process.

Use of digital technologies according to education levels

We were interested in what factors guide the use of digital tools in the direct learning process.

Table 1

Details of the theme The Use of Digital Technology in the Learning Process

Theme	*Category*	*Subcategory*	*Code*
The Use of Digital Technology in the Learning Process	Use of digital technology according to education levels	Use in higher grades	6th grade MT Solfeggio I and II
		Use in lower grades	3rd & 4th grade MT
		Use in preschool programmes	Music preparatory

Within the theme *the use of digital technology in the learning process*, the category use of digital technology according to education levels was highlighted, along with three subcategories: *use in upper grades, use in lower grades and use in preschool programmes*. The participants reported that the use of digital tools is relevant and useful throughout the music education vertical:

"*For me, it's a relief to use the interactive whiteboard in all classes." (T.V_sav.1_I9)*

"*I use it everywhere." (T.IV_JVS_I11, T.VI_sav.2_I6, T.VI_sav.2_I10)*

"*It seems like it would come into play in any class." (T.II_gorenjska_I10)*

"*It can be used anywhere." (T.IV_JVS_I 13)*

Half of the participants emphasized the use of digital technologies, especially in the upper grades of MT (6th grade) and Solfeggio (I and II):

"*I use the computer and projector exclusively in the higher grades of MT." (T.I_osr_I7)*

"*The older they get, the more useful it is." (T.V_sav.1_I8)*

"*I'm using it in the 6th grade." (In T.III_goriška_I11)*

A lower level of use was highlighted in the 3rd and 4th grades of the MT:

"*Also some 3rd, 4th grade." (T.I_osr_I8).*

"*In the 3rd, 4th grade, too." (T.III_goriška_I12)*

The lowest usage rates were reported in the Music preparatory preschool music programme:

"*In the Music preparatory, maybe a little less." (T.VI_sav.2_I7)*

"*In the Music preparatory and in preschool music education, a little less." (In T.VI_sav.2_I10)*

"*In the Music preparatory the least." (T.I_osr_I9).*

Use of digital technologies in music activities

The MT and Solfeggio courses are implemented by working to achieve learning objectives in various music activities, so we were interested in how and in which activities the teachers use digital tools.

Within the theme of music activities using digital technology, the category of use of digital devices (smart whiteboard, computer, projector) and platforms (YouTube, Kahoot) was highlighted.

Table 2

Details of the theme Music Activities Using Digital Technology

Theme	*Category*	*Subcategory*	*Code*
Music Activities Using Digital Technology	Use of digital devices and platforms	Listening	Computer & speakers Audio & video YouTube
		Solfeggio Implementation and interpretation of examples from the musical literature	Kahoot Computer and projector Smart Whiteboard
		Musical didactic games	Smart whiteboard
		Music-theoretical and formal knowledge	Smart whiteboard

In the use of digital devices and platforms category, we found that the participants most often use digital tools for the activity of listening to music. All six participants expressed the need to use digital technology to carry out this activity, and to check the availability of quality videos online:

"*Listening can't be done without it, we mostly listen via YouTube." (T.II_gorenjska_I10)*

"*I use it for the purpose of listening, to see the musicians." (T.I_osr_I10)*

"*To listen to music, to see excerpts from operas." (T.VI_sav.2_I9)*

"*To listen to music and present the musical pieces." (T.VI_sav.2_I14)*

"*To listen to music, to find a soundtrack." (T.V_sav.1_I 16)*

"*You need to check the footage [online]." (T.II_gorenjska_I 12)*

In contrast, the use of digital tools to support the development of rhythmic and melodic abilities during the solfeggio activity is rare, although it was reported by one participant:

"*I have one game on the Kahoot application for recognizing chords that I use with the higher grades, and one for scales with the 3rd grade." (T.III_goriška_I13)*

One participant described using a combination of digital devices for *solfeggio*, *the implementation and interpretation of examples from the musical literature*, and the activity of listening to music:

"*If we have a musical example, we first use parlato, we sing it, and then we listen. Sometimes we have dictations taken from the musical pieces. That's when I always*

let them listen first, so that they remember the musical part more, so that we can write the dictation more easily." (T.VI_sav.2_I8)

For the creating activity, only one participant reported the possibility of using digital tools, but did not mention a specific platform:

"*[We use technology] to create, too. When we were working with the pentatonic and Istrian scales in Solfeggio I, the students were creating music with technology." (T.VI_sav.2_I11)*

In contrast, two participants reported:

"*I don't use those tools for creative work." (T.II_gorenjska_I11)*

"*We use technology the least with creative work. We need our own hands there, and Orff instruments, for the kids to physically grasp, there's no technology." (T.V_sav.1_I 9)*

One participant who used a smart whiteboard reported using it to play *musical didactic games*:

"*There are various didactic games that you can prepare on the board. Playing with melodic, rhythmic patterns is a great way to notice certain patterns by ear. Both older and younger kids are interested in this." (T.V_sav.1_I10)*

The same participant reported using a smart whiteboard when dealing with learning material and carrying out various tasks with regard to *music-theoretical and formal knowledge*:

"*I use a smart whiteboard when dealing with theoretical matters. When completing assignments, they know exactly what task we're doing, and you write the solution [on the board] or the student writes it." (T.V_sav.1_I9)*

The participants reported on the implementation of musical activities using a combination of approaches:

"I'm using a combined approach – with both traditional and digital tools." (T.IV_JVS_I19)

"*I'm excited to see the tools combined across all activities." (T.VI_sav.2_I13)*

When we asked the participants whether digital technologies had been used to create musical activities that could not have been carried out any other way, they did not provide any examples. With the data obtained from the interviews, we conclude that so far no new musical activities have been developed using digital technologies (Puentadura, 2016). By further analysing the statements, we found that the participants use digital devices (computer and projector, smart whiteboard) to project sheet music and tasks in order to carry out *solfeggio* activities, and *implementation and interpretation of examples from the musical literature*.

4 Discussion

This study examine two research questions. With regard to RQ1 – *How do teachers perceive the term digital technology?* – the results showed that teachers see it as an indispensable tool in their private and professional lives. Responses related to the

theme of *Digital Technology* emphasized the use of digital tools when they are comprehensively integrated into the implementation of MT and Solfeggio courses (Redecker, 2017). Teachers' interpretation of the digital technology concept stem from the general technological equipment and digitally supported learning spaces in the school environment. The teachers' statements pointed predominantly to *the standard digital equipment* of the primary classroom (with a computer, projector and music system), less often to *interactive equipment* (with a smart whiteboard) and to *technology-supported halls* (with recording devices, mixing desk) as secondary spaces of the learning process. The results show that international (Ma & Wang, 2025) and national (Breznik & Eyer, 2021) guidelines regarding the use of digital equipment on school premises are taken into account, without which modern teaching can no longer be imagined, as was also reported by the participants, with one noting "*I can't even imagine teaching without digital tools*" (TVI_sav. 2_I 15).

With regard to RQ2 – *How do MT and Solfeggio teachers use digital tools in the implementation of basic music activities?* – both the use of digital technology in the learning process and music activities using digital technology were highlighted. The results showed that the teachers use digital tools across the entire vertical of education in music education. Nevertheless, we found that the level of use of these is conditioned by the level of music education (Smarkola, 2008), and that teachers most often use digital tools in higher grades (6th grade MT, Solfeggio I and II), less often in lower grades (3rd and 4th grade) and least often in preschool programmes (the Music preparatory programme). With regard to music activities using digital technology, we found that teachers most often use digital tools for listening to music, and to search for and share examples available on online platforms (Bohak Adam & Metljak, 2021; Bohak Adam, 2024). In contrast, the use of digital tools in *solfeggio* activities, *the implementation and interpretation of examples from the musical literature, and creative work* is very rare (Bohak Adam & Metljak, 2021), although there is a possibility of accessing online platforms for these activities, especially those that are in a foreign language (Zadnik, 2021). In cases where smart whiteboards can be used, teachers play *music didactic games* with their students to promote the development of auditory-analytical perceptions and consolidate knowledge and skills related to *music-theoretical and formal knowledge* (Bohak Adam, 2024).

Teachers' arguments in support of low or even no use of digital tools are based on the importance of the students' taking an active role, having first-hand experience, and feeling the musical content on a physical level (Rotar Pance & Bohak Adam, 2019). As two participants reported:

> "*You have to practice in music, a computer can't give you the ability to do music exercises if you don't practice" (T.IV_JVS_I21)*

> "*We don't need a textbook, we don't need a smart whiteboard, the kids need to experience the music." (T.I_osr_I18)*

A study conducted on a sample of 175 students enrolled in primary education and preschool education teacher training programmes also showed similar results, finding that "remote learning, as implemented during the epidemic, cannot lead students to achieve the same outcomes as if the study process involving music content were conducted in a classroom setting" (Jenko et al., 2024, p. 111). In our study, we found that

teachers predominantly use digital devices to show materials in class – "*Students are shown materials that do not need to be printed*" (T.I_osr_I11) – while the use of didactic approaches supported by digital technologies is rare.

5 Conclusion

The results of this research show that digital technology is an indispensable and integral part of the learning process in the MT and Solfeggio courses taught by the participants (Caena & Redecker, 2019; Facer & Selwyn, 2021; Redecker, 2017). The results showed no differences between teachers with more and less years of service in terms of the use of digital technologies. Teachers with more years of service feel that technology is an important supportive tool in the planning and implementation of the learning process: "*Sometimes we had to prepare everything for [video]tapes, with MT we only had a notebook...*" (T.VI_sav.2_I 15).

We found that music activities are rarely or not at all supported by digital technologies. Most often, digital technology is used as a didactic tool for listening to music, while other digital devices, such as smart whiteboards, are used to project learning content to the whole class. The findings indicate the predominant achievement of the learning objectives, based on musical activities, using both traditional and blended approaches. New musical activities that could not have been carried out without digital tools have not yet been developed (Puentadura, 2016). Overall, we can conclude that teachers take into account the students' developmental stages, process-developmental and musical-activity oriented lessons in relation to digital technologies. We assume that this is a key reason for the preservation of traditional approaches that encourage the experience and development of musical abilities, skills and knowledge at the sensory and physical levels. Digital technology has a supporting function, especially in the comprehensive integration and integrated support of the implementation of musical activities within the learning process, and to none of the teachers reported using any musical activities that rely solely on the use of digital tools.

It should be noted that this research has some limitations, and the small sample size means that the results cannot be generalized to the entire population of MT and Solfeggio teachers. However, the results do confirm some of those from earlier studies conducted on Slovenian general education (Bohak Adam, 2024; Bohak Adam & Metljak, 2021; Rotar Pance & Bohak Adam, 2019) and in music education (Valant, 2016; Šimunovič, 2020; Zadnik 2021). Given the fact that "we have witnessed a revolutionary advancement in the world of generative artificial intelligence (GenAI) models" (Makovec, 2024, p. 109) and that artificial intelligence is "a new challenge in the educational process" (Dragojević & Letić Lungulov, 2024, p. 98), the results obtained in the present study also raise the question of the appropriate integration and use of such tools in the context of music education. The findings open up the discussion on the current challenges with regard to providing appropriate education and the acquisition of specific digital competences for the subject areas under consideration within formal undergraduate studies, since "educational institutions are playing a central role in promoting digital literacy by integrating it into the curriculum" (Karahasanović et al., 2025, p. 133), as

well as in the continuous professional development of teachers, and the need for further study of digital technologies in music education.

Dr. Katarina Zadnik, Sara Smrekar

Vključevanje digitalne tehnologije pri predmetih nauk o glasbi in solfeggio

Potreba po spodbujanju večjega razvoja digitalnih kompetenc se je najbolj izrazito pojavila v in po obdobju epidemije covida-19 (Blanco-García idr., 2025) ter z aktualnim prehodom v pametno družbo 5.0, ekosistem umetne inteligence in novih tehnologij (Vlada Republike Slovenije, 2023). Tudi na področju vzgoje in izobraževanja se pojavljajo pozivi k preobrazbi strategij poučevanja ter skladno s tehnološkim razvojem po dopolnitvi in nadgradnji digitalnih kompetenc za izzive v 21. stoletju (Caena in Redecker, 2019; OECD, 2019). Na uporabo digitalnih tehnologij v učnem procesu vplivajo tako razvite digitalne kompetence (Hennessy idr., 2022) kot tudi več različnih dejavnikov (Fransson in Lindberg, 2018; Mateos-Moreno in Bravo-Fuentes, 2023). V raziskavah avtorji ugotavljajo (Chen, 2012; Hennessy idr., 2005; Lawrence in Tar, 2018; Rotar Pance in Bohak Adam, 2019), da so učiteljev odnos in pozitivna prepričanja o tem, kako dobro bodo digitalna orodja podprla učni proces in izpolnila njihova učna pričakovanja, eden izmed pomembnejših dejavnikov pri uporabi le-teh. Drožđek idr. (2019) navajajo, da je za uspešno integracijo digitalnih orodij v učni proces pomembno učiteljevo prepoznavanje smiselne rabe teh orodij, ki bodo podprla izobraževalne namene (Lawrence in Tar, 2018; Wise idr., 2011). Rezultati kažejo (Colás-Bravoa in Hernández-Portero, 2023; Kranjc idr., 2020; Lawrence in Tar, 2018; Willis idr., 2018), da so učitelji z bolje razvitimi digitalnimi spretnostmi v boljšem položaju glede presojanja koristnosti vključevanja le-teh v učni proces. Fernández-Batanero idr. (2020) so z analizo 21 izbranih kvalitativnih študij na področju digitalne pismenosti učiteljev ugotovili, da rezultati razkrivajo nezadostno usposobljenost za ustrezno uporabo tehnologije. Bohak Adam (2024) navaja, da večina evropskih držav izvaja pobude za izpopolnjevanje digitalnih kompetenc in uspešno vključevanje tehnologij v pedagoške prakse. Izstopa pa izziv enakopravnega dostopa do usposabljanja in podpore vsem učiteljem (Bohak Adam, 2024; Mičija Palić, 2022). Čeprav Slovenija od leta 1993 namenja finančna sredstva za razvoj digitalnih kompetenc učiteljev in učencev, so rezultati evropske raziskave (Mentoring Technology Enchanced Pedagogy, 2017/18, v Šimunovič, 2020) pokazali, da digitalne kompetence slovenskih učiteljev v primerjavi z učitelji drugih evropskih držav padajo (Flogie in Aberšek, 2019). Slovensko glasbeno šolstvo, ki je zakonsko regulirano (Zakon o glasbenih šolah, 2000, 2006, 2024), organizacijsko vključuje glasbene programe od predšolske glasbene vzgoje, glasbene pripravnice do programa glasba z obveznim instrumentalnim/pevskim poukom ter predmetoma nauk o glasbi (nižja stopnja, 6 let) in solfeggio (višja stopnja, 2 leti). V primerjavi z instrumentalnim poukom ta dva predmeta poudarjata skupinske učne oblike (MIZŠ, 2022a, 2022b). V prispevku se osredotočamo na prisotnost uporabe digitalnih orodij pri skupinskih predmetih nauk o glasbi (v nadaljevanju NGL) in solfeggio. Temeljni cilj obeh predmetov je razviti funkcionalno glasbe-

no pismenost kot temeljno kompetenco slehernega glasbenika, ki se kaže v sposobnosti uporabe glasbenega zapisa kot osnovne vezi med glasbeno (po)ustvarjalnostjo. Ciljno in razvojnoprocesno naravnanost predmetov se dosega z aktivnimi učnimi oblikami na podlagi temeljnih glasbenih dejavnosti. Osrednja dejavnost solfeggio predstavlja ozvočeno glasbeno teorijo in je temeljni kamen v razvoju funkcionalne glasbene pismenosti. Dejavnost izvajanje in interpretacija primerov iz glasbene literature poglablja glasbene predstave in znanja ter razvija glasbeno pismenost z doživetim izvajanjem primerov iz glasbene zakladnice in medpredmetnimi povezavami. Dejavnost poslušanje spodbuja razvoj sposobnosti analitičnega in kombiniranega poslušanja glasbenih elementov. Pri dejavnosti ustvarjanje je razvoj glasbene pismenosti podprt z zapisovanjem ustvarjenih glasbenih vsebin v standardni glasbeni zapis. Glasbene sposobnosti, spretnosti in znanja, ki jih pridobijo s temeljnimi dejavnostmi, se kažejo na področju glasbenoteoretičnih in oblikovnih znanj (Zadnik, 2019).

Na področju digitalnih kompetenc v glasbenem šolstvu je Valant (2016) že pred desetletjem na vzorcu 110 učiteljev ugotovila, da so ti najpogosteje uporabljali videoposnetke za poslušanje glasbenih izvedb (93 %), aplikacije z metronomom za ohranjanja tempa (51 %) in digitalna orodja za snemanje glasbenega izvajanja v učnem procesu (49 %). Izbruh epidemije je terjal uporabo digitalnih orodij kot edino možno obliko poučevanja in učenja na daljavo v sinhronih in asinhronih oblikah (Blanco-García idr., 2025; Gerlič, 2013). Šimunovič (2020) je ugotovila, da je imel tedaj prehod na učenje na daljavo pozitiven vpliv na dvig digitalnih kompetenc tako pri učiteljih kot učencih, s tem da so učitelji inštrumenta ocenili delo na daljavo za manj kakovosten način poučevanja. Zadnik (2021) je za skupinska predmeta NGL in solfeggio ugotovila, da so bili inovativni didaktični pristopi z uporabo digitalnih orodij tedaj v manjšini, prevladovali so tradicionalni pristopi, podobni klasičnemu načinu poučevanja v razredu. Nedavne raziskave kažejo na nestalnost uporabe digitalnih orodij v glasbenem šolstvu, ki so pretežno plod študij primerov. Podobno kot Marovič idr. (2025), ki so z analizo sinteze relevantne literature ugotavljali pozitivne učinke metode obrnjenega učenja, sta v okviru pilotne študije pri predmetih NGL in solfeggio Suljić in Miklič (2024) ugotovila, da ima kombiniran tip poučevanja z uporabo videolekcij pri domačem delu pozitivne učinke na razumevanje glasbenoteoretičnih elementov, na zbranost in pozornost učencev. Kramar idr. (2024) so v okviru študije primera potrdili pozitivne učinke uporabe vizualnih, avdio in avdiovizualnih pripomočkov na "a vista branje" (na prvi pogled) notnega zapisa tako pri pouku inštrumenta, NGL kot solfeggiu. Ugotovljene vrzeli neopravljenih raziskav na področju digitalnih tehnologij pri predmetih NGL in solfeggio so bile spodbuda za izvedbo pričujoče raziskave. V raziskavi nas je zanimalo, kako digitalna orodja podpirajo izvajanje petih dejavnosti: solfeggio, izvajanje in interpretacija primerov iz glasbene literature, poslušanje, ustvarjanje, glasbenoteoretična in oblikovna znanja. Želeli smo ugotoviti, kako učitelji omenjenih predmetov uporabljajo digitalna orodja in kako si razlagajo pojem digitalna tehnologija. Zastavili smo si naslednji raziskovalni vprašanji: 1) Kako učitelji NGL in solfeggia pojmujejo termin digitalna tehnologija? in 2) Kako učitelji predmetov NGL in solfeggio uporabljajo digitalna orodja pri izvajanju temeljnih glasbenih dejavnosti?

Neslučajnostni način vzorčenja je vključeval vzorec šestih učiteljev NGL in solfeggia iz različnih regij Slovenije: osrednjeslovenska (1), gorenjska (1), obalno-kraška (1), savinjska (2), jugovzhodna Slovenija (1). Povprečna delovna doba je bila 18,5 leta

($\bar{x}$ = 18,5 leta), stopnja izobrazbe učiteljev je bila magister profesor glasbe po bolonjskem sistemu (N = 2) oz. profesor glasbe, ki je veljala pred bolonjskim sistemom (N = 4). Uporabili smo polstrukturirani intervju, s katerim smo pridobili informacije o delovni dobi, pojmovanju digitalne tehnologije, opremljenosti učilnic, uporabi digitalne tehnologije pri izvajanju glasbenih dejavnosti v razredih NGL in solfeggia. Intervjuje, ki so trajali od 20 do 40 minut na daljavo, smo izvedli in z dovoljenjem udeležencev posneli v decembru 2024. Uporabili smo kvalitativni pristop s tematsko analizo (Braun in Clarke, 2012). Dobljene kode ročno obdelanih transkriptov smo združevali v (pod) kategorije in teme. Varstvo podatkov smo zagotovili s psevdonimizacijo in dodelitvijo raziskovalnih kod udeležencem.

Rezultat kvalitativne raziskave, ki je temeljila na tematski analizi izvedenih polstrukturiranih intervjujev z induktivnim pristopom, je ugotovitev, da so glasbene dejavnosti redko podprte z digitalnimi tehnologijami. Ugotovili smo, da je stopnja uporabe pogojena s stopnjami glasbenega izobraževanja. Najpogosteje se digitalna orodja uporablja v višjih razredih (6. razred NGL, solfeggio I in II), manj pogosto v nižjih razredih (3. in 4. razred) in najmanj v predšolskih programih (glasbena pripravnica). Ugotovili smo, da jih učitelji najpogosteje uporabljajo pri dejavnosti poslušanje (Bohak Adam in Metljak, 2021; Bohak Adam, 2024), zelo redko pri dejavnostih solfeggio, izvajanje in interpretacija primerov iz glasbene literature ter ustvarjanje (Bohak Adam in Metljak, 2021; Zadnik, 2021). Rezultati so pokazali na omejen dostop do pametne table in potrdili, da naprava podpira izvedbo glasbenih didaktičnih iger za spodbujanje razvoja slušno-analitičnih zaznav ter utrjevanje glasbenih elementov na področju glasbenoteoretičnih in oblikovnih znanj (Bohak Adam, 2024). Ugotovili smo, da se digitalne naprave najpogosteje uporablja za projiciranje učnih vsebin. Argumentacije učiteljev za nizko uporabo digitalnih orodij izhajajo iz pomena učenčeve aktivne vloge, doživljanja in občutenja glasbenih vsebin na slušni in telesni ravni. Za doseganje učnih ciljev prevladujejo kombinirani in tradicionalni pristopi, medtem ko se nove glasbene dejavnosti, ki jih brez digitalnih orodij ne bi bilo mogoče izvesti, niso razvile (Puentadura, 2016). Rezultati niso pokazali razlik pri rabi digitalnih tehnologij med učitelji z več in manj let delovne dobe. Ugotavljamo, da ima digitalna tehnologija svojo podporno funkcijo pri kompleksnem povezovanju in integrirani podpori izvedbe glasbenih dejavnosti. Ugotovitve potrjujejo nekatere rezultate že izvedenih raziskav na tem področju v slovenskem splošnem izobraževanju (Bohak Adam in Metljak, 2021; Bohak Adam, 2024) in glasbenem šolstvu (Šimunovič, 2020; Zadnik 2021).

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Dr. Katarina Zadnik, Associate Professor at the Academy of Music, University of Ljubljana, Slovenia.
E-mail: katarina.zadnik@ag.uni-lj.si

Sara Smrekar, Master of Music Education, Assistant at the Academy of Music University of Ljubljana, Slovenia.
E-mail: sara.smrekar@ag.uni-lj.si