A Quantitative Survey of Digital Competencies of Music Teachers in the European Union

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Abstract: In this paper we offer a quantitative survey of the digital skills of music teachers practising in the European Union. As part of the Erasmus+ Digital Skills for Music Teachers (DISK) project, one of the work packages is to see how well they are integrated into the everyday teaching of music teachers of all specialisations, from junior level to conservatoire. To examine this we conducted an online survey that first quizzed teachers on their experiences through a combination of quantitative Likert scale ratings and open-ended feedback. We present the results and initial analysis of 221 teachers' responses and conclude with a discussion of the next steps based on this data.

1 INTRODUCTION

Teachers and educators need a broad toolkit of digital skills and strategies in the delivery of high quality tuition to their students. In the case of music institutions and conservatories, the application of digital skills is particularly challenging due to the specialist, applied and practical nature of delivery. Instrumental and ensemble tuition is principally a physical, in-person and interactive activity that poses major hurdles when attempting to coordinate over video teleconferencing solutions like Zoom and Microsoft Teams.

These challenges were accelerated and brought to the fore during the COVID-19 pandemic, which saw institutions and teachers at all levels forced to adapt and bring their lessons online within a very short and intense period of time. Meanwhile, educators across all disciplines are constantly evolving and adapting to profound developments and obstacles in areas like artificial intelligence (AI) and cybersecurity.

The Erasmus+ project Digital Skills for Music Teachers (DISK) was initiated in 2024 by three conservatories from Spain, Ireland and Estonia to study the role of digital technologies in music education and prepare frameworks and modules for upskilling its practitioners. It builds on knowledge gained through the completion of the previous New Skills for New Artists (NS4NA) that produced as its primary output a set of reusable Creative Commons licensed materials for enhancing the entrepreneurial and technical skills of recent music graduates (noa, 2022).

The DISK project seeks to extend this work to music teachers with the following objectives.

1. To provide a scientific framework for the development of various strategies for the digitisation of music education.
2. To design and test a training curriculum in digital competencies for music teachers.
3. To generate a toolbox for scaling up the digitisation of music education at the European level.

The most noticeable differentiator is its evidence-based approach at the outset. To provide justification for developing and testing a high quality curriculum we describe in this paper a large-scale quantitative survey that examines the extent of digital skills among 221 music teachers.

The European Framework for the Digital Competence of Educators (DigCompEdu) provides a "scien-

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tifically sound framework describing what it means for educators to be digitally competent" (Redecker, 2017). Since then there has been significant research investigating and implementing the framework within European educational institutions (Buckley and Pears, 2021; Economou, 2023), including several surveys that evaluate digital competencies using qualitative (Ghomi and Redecker, 2019; Rubio-Gragera et al., 2023) means. In the context of music education there have been several surveys published (Pabst-Krueger and Ziegenmeyer,), with many focussing on the Spanish system (Guillén-Gámez and Ramos, 2021; García et al., 2021; Cuervo et al., 2023)

The paper is structured as follows. Section 2 describes the methodology from instrument design to. Section 3 discusses some of the results. Section 4 concludes with some overall remarks and discussion of the next steps.

2 METHODOLOGY

2.1 Survey Design and Pilot

The survey design phase commenced with a series of online brainstorming sessions between the 3 partner conservatoires in an effort to provoke discussion, solicit ideas and generate as many possible questions as possible. These were all collected loosely in shared documents that allowed further review and discussion after formal meetings via comments.

Questions were refined based on relevance or redundancy and transferred to a spreadsheet were organised thematically into sections that align with the following areas of study of the project (as well as an introductory "general profile" category to aid with subgrouping and data slicing later):

1. General Profile
2. Basic and transversal digital skills
3. Online safety and addressing ethics within the new technological environment
4. Pedagogical skills
5. Specific Skills for digital teachers

Question types (e.g. multiple choice versus multiple answer) and possible options for the questions were captured. Next the questions were coded into a Microsoft Forms survey. Using manual and machine-assisted translation the surveys were localised for Spanish and Estonian. This pilot survey was then shared with 5 colleagues from partner institutions but who were not associated directly with the project for independent feedback and testing.

2.2 Data Collection

After addressing pilot feedback, the survey was refined and finalised for collection from the sample population. The survey was shared firstly amongst colleagues within the three conservatory partner institutions, then widened to other institutions in the networks of the partners. In addition we targeted specific organisations and social media channels related to music pedagogy, particularly the Association of European Conservatoires (AEC).[1]

2.3 Data Analysis

Following the closing of the data collection window, the survey results were downloaded in Excel format from the Microsoft Forms backend. The data was ingested into Python using the Pandas data analysis and manipulation library (pandas development team, 2024; McKinney, 2010). Readable ordinal categories such as age, years teaching and Likert ratings were replaced with integers to aid numerical analysis.

Preliminary descriptive statistics were carried out using pandas and numpy. Inferential statistics were performed using statsmodel (Seabold and Perktold, 2010). Microsoft Forms helpfully prepares some simple pie and bar charts, which were supplemented with more detailed graphs prepared in matplotlib (Hunter, 2007) and seaborn (Waskom, 2021).

3 RESULTS

3.1 Reliability

The Likert ratings were first examined to ensure sufficient reliability using Cronbach's alpha measure as carried out in the work of. We reported a high alpha coefficient of 0.964177 within a confidence interval of 0.957 - 0.971 a which can be interpreted to indicate that the scale we have used has high internal consistency.

3.2 Descriptive Statistics

3.2.1 General Confidence Profiles

Figure 1 shows the distribution of responses for the general questions gauging participants' confidence in the high-level category descriptors. While not as precise, these broad category questions act as a useful

[1] https://aec-music.eu/news-article/digital-skills-4-music-teachers-disk/

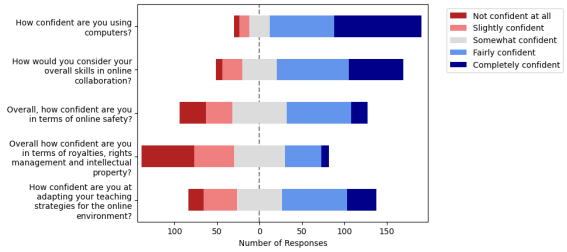
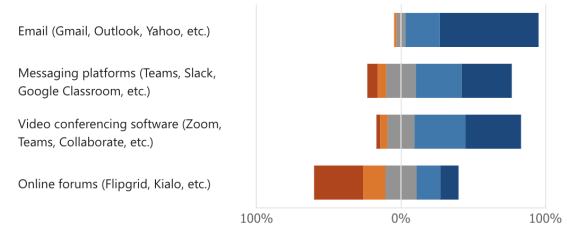
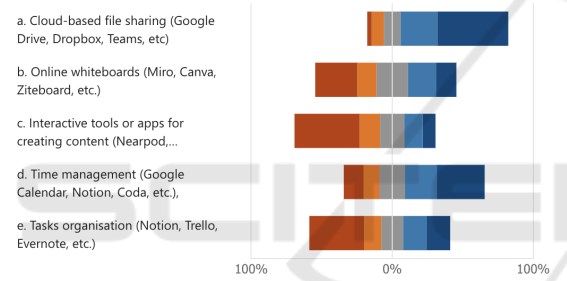


Figure 1: High-level Confidence Categories.



(a) Communication.



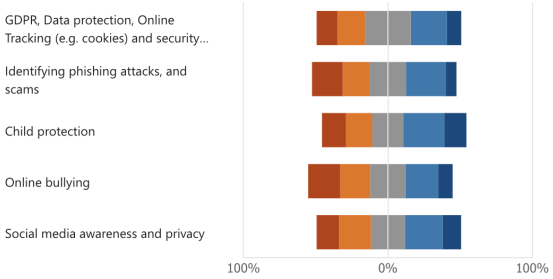
(b) Productivity.

Figure 2: Confidence Ratings - Basic Digital Skills.

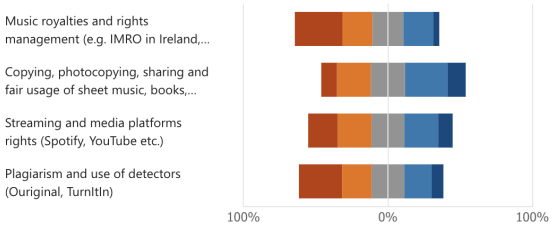
control and broad indicator for the precise questioning that follows in preceding sections.. Most of the participants indicate that they are broadly confident in their use of computers, while the most notable lack of knowledge lies in the area of online safety, copyright and intellectual property

3.2.2 Basic Digital Skills (Communication and Productivity)

In the category of basic digital skills we queried the abilities of music teachers in general digital competencies not unique to music pedagogy - such as usage of common communication and productivity tools. Figure 2 shows the distribution of scores in these two categories. Encouragingly, our participants scored consistently high for tools like email, cloud storage and telecommunication, indicating a baseline literacy and understanding. Lower scoring categories such as forum usage, task organisation and interactive apps indicate that teachers may not be aware or have the time to discover more bespoke tools.



(a) Safety.



(b) Ethics and Intellectual Property.

Figure 3: Confidence Ratings - Safety, Ethics and Intellectual Property.

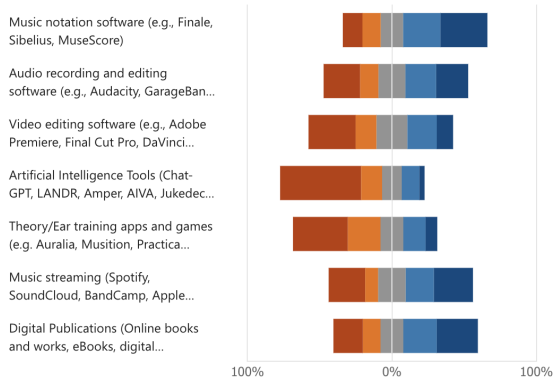
3.2.3 Safety, Ethics and Intellectual Property

A constant challenge and concern for music teachers with digital delivery at all levels - but especially younger children - is the issue of online safety. Figure 3a shows a fairly balanced distribution of scores with the lowest weighting in the categories of phishing and online bullying. This reflects the often smaller size of music teaching schools in many communities who may not have the resources, budget or knowledge to develop formal policies and train their staff effectively in these highly important issues.

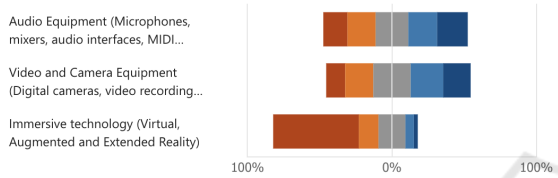
Another unique issue in music education delivery is the issue of copyright and intellectual property. Music teachers make frequent use of wide-ranging multimedia resources in addition to sheet music and recordings. Professional music performers leaving music institutions also need to understand how music royalties and intellectual property is handled in their regions. Our survey revealed a marked lack of understanding in the latter. In this section we also asked about teachers' knowledge of automatic plagiarism detectors, commonplace in other disciplines but likely less so in music tuition due to the practical nature of delivery. This is reflected in the lower distribution of scores for this quality.

3.2.4 Specific Digital Skills

Our final category queried the usage of specialised tools for music tuition, divided by software and hardware. The software tools examined the teachers'



(a) Software.



(b) Hardware.

Figure 4: Specific Digital Skills.

awareness or familiarity with music pedagogy specific and adjacent software skills such as notation software, audiovisual editing and theory apps along with new AI innovations. As expected but still very skewed, teachers are very unprepared for the impact of Chat-GPT, but also music specific generative applications that can compose or co-create music. Many teachers are also unaware of the benefit of theory and ear training apps that allow students to interactively improve such skills in their own time.

3.3 Inferential Statistics

3.3.1 Overall and Individual Confidence Relationship

Our first and most intuitive hypothesis is that individuals who rate themselves confident in the overall control question should be reflected in the categorical confidence ratings. To test this hypothesis we computed the Spearman's rank correlation coefficient between the overall confidence and each individual facet. We report moderate correlations (0.4 - 0.7) in all instances and all coefficients are statistically significant with ($p < 0.05$) as indicated in the heatmap in Figure 5.

3.3.2 Effect of Age

We were interested in studying the effect of age and on the digital expertise and confidence of music teachers. A possible hypothesis would suppose that older teachers who rely on more traditional methods of tuition would be less confident in terms of digital skills.

To investigate this we firstly computed Spearman's rank correlation between the ordered age variable and each of the general confidence categories. Table 1 shows the top 5 correlation coefficients along with the significance levels. As we can see there are

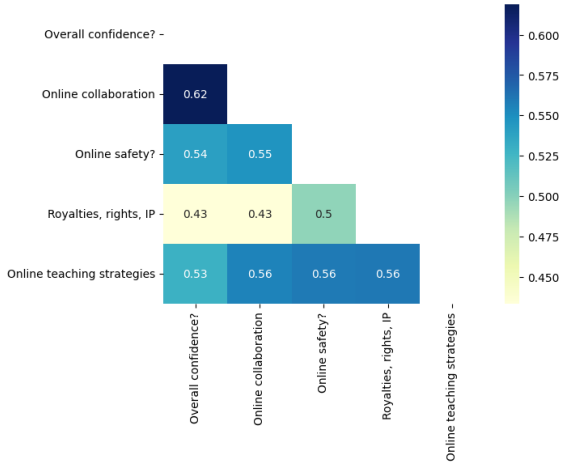


Figure 5: Overall and Individual Confidences - Correlation Heatmap.

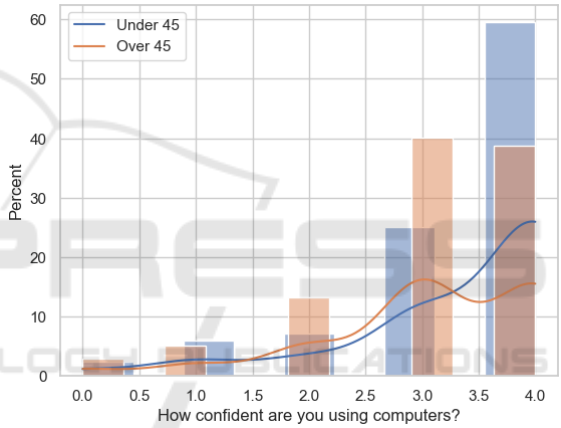


Figure 6: Confidence of Under-45s versus Over-45s.

Table 1: Overall Confidence Correlation Analysis.

General Category	Spearman's rho	p-value
Online collaboration	-0.217865	0.001115
Overall confidence	-0.191543	0.004265
Online safety	-0.127213	0.059010
Online teaching strategies	-0.100994	0.134472
Royalties, rights, IP	-0.003983	0.953052

Table 2: Specific Confidence Correlation Analysis.

Digital Competency	Spearman's Rho	Significance Level
Music streaming (Spotify, SoundCloud, BandCamp, Apple Music)	-0.324158	0.000001
Theory/Ear training apps and games (e.g. Auralia, Musition, Practica Musica, Ear Master)	-0.236085	0.000400
e. Tasks organisation (Notion, Trello, Evernote, etc.)	-0.234820	0.000431
Digital Publications (Online books and works, eBooks, digital workbooks, online repositories)	-0.230316	0.000559
d. Time management (Google Calendar, Notion, Coda, etc.),	-0.218825	0.001059
a. Cloud-based file sharing (Google Drive, Dropbox, Teams, etc)	-0.218761	0.001063

weak negative correlations but statistically significant effects of age on the overall digital confidence and online collaboration.

In terms of specific digital skills we drilled down and performed the same procedure with all the Likert confidence ratings. Table 2 overleaf shows the sorted table of the top 5 correlation coefficients and their significant levels, indicating a number of statistically significant relationships with aspects such as digital productivity, music streaming and music theory apps.

Another approach was to compare specific groups by partitioning the participants into two age groups above and below age 45. Figure 6 shows the superimposed bar plots of the percentage scores. Performing this sort of division allowed us to compare the central tendencies of both groups, using additional statistical tests. Comparing the medians (under-45 = 4.0, over-45 = 3.0) we performed a Mann-Whitney U test to establish whether the medians of the two groups are statistically different. This was confirmed with a statistic=5854.0 and a significant p-value=0.0121.

4 CONCLUSIONS AND NEXT STEPS

In this paper we presented initial findings of a quantitative survey of the digital skills of music teachers practising in the European Union. We introduced the aims of the survey in the context of the DISK Erasmus+ project, which seeks to offer an evidence-based approach to digital skills enhancement of those teachers.

We produced descriptive and inferential analysis of the results that revealed important aspects and gaps in the knowledge of the music teachers under scrutiny. Many of these details were suspected from the outset i.e. a lack of awareness around next generation tools such as AI and immersive technologies. Others were more surprising, such as the lack of uptake in theory training apps and games and understanding of music royalties.

Our next steps are to follow up the quantitative survey with a qualitative instrument that will give texture to the numerical data through a series of semi-structured interviews with selected music teachers. We are also producing a similar quantitative survey that gives the perspective of students and their impressions of the extent of digital usage within their classrooms. The evidence we are gleaning from these experiments have proved highly informative as we prepare materials for the delivery of training modules in the next work package, and as we gather more data we are constantly refining the content to meet the needs of the music teachers in the EU.

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