Conservatory and music school teachers' experiences with videoconferencing software during and after the COVID-19 pandemic

Ana Martínez-Hernández

With the abrupt onset of the global lockdown in spring 2020, teachers had to adjust their teaching mode by using videoconferencing platforms for several months. In the academic year 2020–2021, instruction shifted to a mode of blended learning where face-to-face lessons were prioritized, and remote learning was employed in specific contexts. This study examined the experiences of conservatory and music schoolteachers with videoconferencing software, their preferences, difficulties faced, and conclusions drawn after having taught online. A survey was sent to all conservatories and some music schools in Spain for data collection, eliciting 485 responses. As per the study's findings, most participants preferred face-to-face lessons before and after the lockdown. Zoom, Skype, Google Meet, and WhatsApp were the most frequently used platforms, of which Zoom and Skype were correlated with better student performance and satisfaction. Video calls were generally combined with other asynchronous methods to enhance learning.

Keywords: videoconferencing platforms; music education; remote learning; COVID-19; conservatories

Introduction

In early 2020, the COVID-19 pandemic forced all education systems to shift to an online mode, without any notice or time to prepare for such a transition. Against the backdrop of music instrumental instruction, each teacher, guided by their institution, peers, or their own previous experience, chose to continue with lessons over various videoconferencing software in the best possible manner.

Before the pandemic, several interventions had been made with remote learning in one-to-one instrumental lessons. These studies showed that the benefits were generally associated with the facilitation of international collaborations, remote

rehearsals, and masterclasses while reducing travel, time costs, and harmful emissions. The drawbacks were issues associated with audio and video quality, latency, adaptation of the teaching process, and acclimation to the technology (Lisboa et al., 2020). As part of the curricula, these studies were undertaken willingly with the support and supervision of researchers or institutions, and were planned, organized, and designed (Hash, 2020). However, this was not the case during the COVID-19 pandemic, where it was the context that imposed such a change. Thus, studies on online education during the lockdown may be regarded as a mode of emergency remote teaching and require careful comparison with previous research (Calderón-Garrido & Gustems-Carnicer, 2021).

This study aimed to investigate the experiences of music teachers with videoconfercing software, their preferences, difficulties, and conclusions after having taught online for several months during and after the COVID-19 lockdown. The main questions guiding the research were (1) Which videoconferencing platforms were used and preferred by teachers? (2) Was this preference associated with the instrument taught? (3) What resources were used to complement videoconference lessons? (4) Did teachers' perception of online learning change after the lockdown? Also, regarding teachers' perception (5) Which students obtained better learning results? (6) To what extent were students satisfied with online learning? To gather this information, a survey was sent and answered by 485 Spanish teachers who worked mostly in conservatories.

Literature review

Online teaching before COVID-19 pandemic

There is abundant literature concerning instrumental music teaching via videoconferencing that was undertaken before the 2020 worldwide pandemic. Most of

the studies have been conducted with Skype, the most popular and free videoconferencing platform till around 2012, when it had 31 million users, and 560 million people had used it on some occasions (Janghorban et al., 2014). Also, the main instrument researched was the piano due to the facility of transforming sound to MIDI (Comeau et al., 2019; Kruse et al., 2013; Pike, 2020; Pike & Shoemaker, 2013).

Studies have shown benefits in convenience (schedule, time-saving, transportation, and payment) and international collaboration (Koutsoupidou, 2014) and the possibility of teaching in rural areas where, otherwise, instrumental tuition would not be accessible (Shoemaker & Van Stam, 2010). Drawbacks were related to the difficulties of using the technical equipment, latency, background noise, and psychological circumstances derived from online teaching (King et al., 2019; Kruse et al., 2013; Stevens et al., 2019). Some studies have emphasized that videoconferencing could be used to supplement face-to-face lessons (Dammers, 2009) or combined with asynchronous methods.

To improve the quality of instruction, many researchers have created their own software in combination with hardware (e.g., microphones, speakers) to connect remote areas (Yamaha, 2005, as cited in Comeau et al., 2019). Examples of this are MusicGrid in Canada (Parkes & Comeau, 2015) and iMCM in Australia (Stevens et al., 2019).

Latency issues have also been addressed by creating specific software designed to obtain real-time collaborations across large distances. An example of this is the LoLa low-latency software, which has been used mostly in performances in concert halls and music universities (Davies, 2015; Drioli et al., 2013; Riley, 2016; Smith et al., 2020). As an online teaching tool, LoLa has yielded good results in many locations around the world (Redman, 2020). Other open-source platforms that aim to reduce latency are JackTrip (Cáceres & Chafe, 2010; JackTrip, 2021), Mumble (Adam, 2022),

JammerNetz (https://github.com/christofmuc/JammerNetz), Jamulus (https://jamulus.io/), SonoBus (https://www.sonobus.net/), SoundJack (https://www.soundjack.eu/), Digital Stage (https://www.soundjack.eu/), and Sagora (https://sagora.org/?lang=en).

All these studies on online learning have established the foundations for the measures taken by institutions and teachers during the lockdown. However, it is important to distinguish between online learning and emergency remote teaching (Hodges et al., 2021) as the second implies teachers and students had to operate in conditions of distress for many months, which had an impact on the learning process (Camlin & Lisboa, 2021).

Emergency remote teaching during COVID-19 pandemic

Due to the COVID-19 pandemic, all education moved online in most countries in a matter of days. Music instrumental education was transformed, and all teachers and students had to make the change to remote learning, regardless of preparation or means.

Since then, a number of articles have been published on this subject. For example, *The Music Education Research* journal published a special issue called *The digital 'Turn' on Music Education* (Camlin & Lisboa, 2021), which explored the implications of this *turn* for music educators, students, and families. It provided evidence of the ways in which educators and music researchers responded to the crisis. In particular, Camlin and Lisboa distinguished between online learning and emergency remote teaching, highlighting the idea that the sudden lockdown should not contribute to the binary thinking of online and offline education, as both need to be considered in the future devising of curricula.

During the pandemic, teachers modified their pedagogical approaches guiding students in more learner-centered approaches and promoting interpersonal

connectedness through discovery and musical experience (De Bruin, 2021). Teachers also reported having used complementary material, such as recordings of themselves, recordings of professionals, or specific software (Hash, 2020; Kesendere et al., 2020). Likewise, students experienced benefits from the change to online learning. They claimed to have more time to study (as time travel had disappeared), opportunities to learn more about musical software, and predisposition to online collaboration (Daubney & Fautley, 2020; Johnson & Merrick, 2020; Merrick 2020; Schiavio et al., 2020).

In the case of Spanish music schools and conservatories, studies pre-COVID-19 showed limited use of technologies and low motivation to use them (Díez, 2018). When dealing with emergency online teaching, teachers focused on finding resources to continue with their lesson plans and pedagogic approaches (Palau et al., 2020).

The lockdown of COVID-19 has shown the potential of online learning in music education, and since teachers had to spend many hours working with digital resources, they could be more open to the future implementation of technologies in instrumental teaching (Spieker & Koren, 2021).

Videoconferencing software for online instruction

Although there is some recent research on the online turn of music education, the use of videoconferencing software, the choices made by teachers and institutions, and the results of and opinions on these choices have not yet been thoroughly analyzed. However, on webpages or blogs, many music teachers and educators have posted their opinion, advice, and trials on some of the most popular videoconferencing software. Skype was the most popular videoconferencing software for some time, but since the lockdown, many others have gained popularity. Zoom, Microsoft Teams, Google Hangouts, Google Meet, and FaceTime apps are some of the most popular platforms that have also been used for synchronous online teaching (Chadwick & Veitch, 2020;

Ozolins, n.d.; Rieira, 2021; Yee, 2020).

Also, a great number of websites offering online music lessons have flourished during the lockdown. Professionals from a wide range of countries and music backgrounds use these websites to advertise themselves. Among the most popular websites are TakeLessons, Musidoo, Lessonface, and Play with a Pro (Quora, 2021; TechBoomers, n.d.; Washo, 2020).

Methodology

This study employed a quantitative survey methodology (Creswell, 2004) to identify attitudes and opinions of instrumental music teachers on the use of videoconferencing software. The survey was developed after reviewing the literature, consulting with music educators, and perusing blogs, websites, forums, and social media connected to this subject. The initial draft was reviewed by two music education faculty members and two instrumental precollege-level conservatory teachers. Revisions were made based upon their recommendations, and the pilot survey was sent to 20 teachers to check for clarity and usability. The final version of the survey was administered using Google Forms. An email requesting collaboration with the study was sent to the directors of Spanish precollege and college conservatories. Numerous music schools in the province of Madrid were also contacted. The directors of the music schools and conservatories who expressed their willingness to participate were sent the link of the Google Forms survey, which they then forwarded to the teachers. On the first page, the participants were informed about the aim of the study and guaranteed that the information they provided would be kept confidential and anonymous and that the return of the completed questionnaire would be considered informed consent. Participation was open from January 2021 to March 2021, and 485 responses were registered. At that time, students could attend lessons in conservatories and music

schools following safety protocols. Individual face-to-face lessons were permitted, while chamber music, ensemble, and orchestra lessons had to follow extra safety measures related to social distancing and capacity limitations. In some institutions, wind ensembles or orchestras were taught online due to the high risk of COVID-19 transmission.

The survey consisted of 22 dichotomous, multiple-choice, and open-ended questions on demographics and the use of videoconferencing platforms during and after the COVID-19 lockdown. Questions referred to the frequency of use, preferred platforms and reasons, advantages and disadvantages, change of perception in online teaching, students' satisfaction, and student performance divided by age group. Open-ended questions were used to provide context to multiple-choice answers. The survey took approximately 2 minutes to complete. The study was approved by the ethics committee of CES Don Bosco.

Data were analyzed using SPSS for Windows software version 25. Kolmogorov-Smirnov test was performed to assess for normal distribution with a significance level set at $p < .05$. Descriptive and nonparametric tests (χ tests) were used, as data were not normally distributed.

Results

Demographics

The sample consisted of 485 instrumental music teachers of different age ranges as seen in Figure 1.

[INSERT FIGURE 1 ABOUT HERE]

The youngest age group was reduced in the sample because at this age the majority of musicians are still studying. The oldest age group also was reduced possibly

because of a minor use or interest in technologies (Chadwick-Dias et al., 2004). Respondents worked mostly in conservatories (*n* = 401; 82.7%), in music schools (*n* = 144; 29.7%), as private teachers (*n* = 52; 10.7%), in schools (*n* = 30; 6.2%), and in university (*n* = 3, 0.6%).

Instruction

Years of teaching experience were less than 5 years (*n* = 31; 6.4%), 5–9 years (*n* = 43; 8.9%), 10–14 years (*n* = 83; 17.1%), 15–19 years (*n* = 71; 14.6%), 20–30 years (*n* = 166; 34.2%), and more than 30 years (*n* = 91; 18.8%). Teachers taught all levels of education (Figure 2) and a variety of instruments—mainly wind, string, and keyboard (Figure 3).

[INSERT FIGURE 2 ABOUT HERE]

[INSERT FIGURE 3 ABOUT HERE]

Videoconferencing platform preferences

Before the lockdown of spring 2020, most participants (*n* = 441; 91%) had never taught lessons online, while 9% (*n* = 44) had some experience in this regard. After the lockdown, the number of participants that had taught online rose to 471 (97.1%) and the ones who had not taught online decreased to 14 (2.9%). A total of 46% percent (*n* = 223) had only taught with videoconferencing platforms during the lockdown and an additional 9.9% (*n* = 48) continued teaching online only when a student had to temporarily stay in isolation. At the time the survey was completed, 5.2% (*n* = 25) taught online every day, 18.6% (*n* = 90) several times a week, 12.8% (*n* = 62) several times a month, and 4.7% (*n* = 23) several times during the year.

Most respondents (n = 421; 86.6%) preferred to teach only face-to-face, while only 13% (n = 63) preferred blended learning, and none preferred online teaching. Of those participants who chose blended learning, 74% (n = 47) preferred a combination of 25% online and 75% face-to-face, 15% (n = 10) a combination of 50% and 50%, and 6% (n = 4) 75% online and 25% face-to-face.

[INSERT TABLE 1 ABOUT HERE]

As seen in Table 1, Zoom, Skype, Google Meet, and WhatsApp were the most frequently used platforms. Taking into account the entire sample, Skype, Zoom, Google Meet, and Microsoft Teams were the preferred platforms. Similarly, the platforms with the highest preferred rates among their users were Zoom, Google Meet, and Skype. WhatsApp, although widely used, was preferred only by 7.2% of its users. This also occurred with Google Hangouts, which was known by 13.8% of the participants and chosen as preferred by 0.4%.

Some of the reasons given for choosing the preferred platform were:

- Skype: free, good audio and video quality, ease of use, known by more students, the possibility of recording the lesson, less delay, easy access, and stability.
- Zoom: good audio and video quality, less latency, stable with a large number of participants, ease of use, and many possibilities to share content. Many participants valued highly the possibility of choosing audio preferences.
- Google Meet: audio quality, stability, ease of use, unlimited time use, good integration with Google Classroom.

- Microsoft Teams: the possibility to program Google Meetings, ease of use, stability, the possibility of other options to improve learning (e.g., upload documents, grading).
- WhatsApp: stability, ease of use, quick and easy access, well-known by parents and students.
- FaceTime: stability, sound quality, ease of use, and unlimited time.
- Webex: Adapted for instrumental teaching, sound quality.

In several cases, Microsoft Teams, Google Meet, and Webex were the platforms required by some conservatories and music schools. In addition to synchronous teaching, participants complemented instruction with videos from YouTube or similar platforms (n = 197; 40.6%) and videos of themselves (n = 299; 61.6%), and asked students to record themselves studying (n = 397; 81.9%).

Chi-square test reported no statistical difference between preferred videoconferencing software and age ($\chi 2$ = 91,023; p = .64), experience in teaching ($\chi 2$ = 43,276; p = .333), instruments classified by pitch ($\chi 2$ = 38,218; p = .843), and instruments classified by families ($\chi 2$ = 40,115; p = .465). However, a statistical difference was found between preferred videoconferencing software based on the autonomous community (regional autonomous governments) where participants worked ($\chi 2$ = 472,605; p = .000). Webex was preferred mostly in Galicia (31.3%) over other platforms, Skype was preferred in Valencian Community (37.7%), and Google Meet was preferred in Baleares (50%), Murcia (38.2%), and Extremadura (64.3%). In Madrid, the preferred platforms where Skype (23.9%) and Zoom (31%), and in Cataluña, Zoom (32.3%) and Google Meet (33.9%).

Perceptions of online teaching

Most participants taught lessons using videoconferencing software because it was the only possibility both during the lockdown and after it ended, due to the isolation of teachers and students (n = 464; 95%). Some teachers reported wind ensembles were still taught online because of the risk of COVID-19 transmission. Additionally, the lack of physical space in music schools and conservatories due to classroom-student ratios promoted online teaching. Other reasons given for using videoconferencing pertained to the benefits detailed in Figure 4. Online teaching drawbacks yielded by the survey can be seen in Figure 5.

[INSERT FIGURE 4 ABOUT HERE]

[INSERT FIGURE 5 ABOUT HERE]

After the lockdown, more than half of the participants (n = 253; 52.2%) had changed their perception of online teaching, 19.2% (n = 93) were not sure, and 28.7% (n = 139) had not changed their perceptions. A total of 67% (n = 325) of the teachers believed that students had learned less with online lessons compared to face-to-face, 23.7% (n = 115) believed they had learned the same, and 9.3% (n = 45) believed they had learned more in online lessons than face-to-face. Statistical differences were found using chi-square test between learning online and age ($\chi 2$ = 38.285; p = .004), experience in teaching ($\chi 2$ = 18.931; p = .041), preferred videoconferencing platform ($\chi 2$ = 31.674; p = .011), and preference for online or face-to-face lessons ($\chi 2$ = 38.285; p = .000). Contingency tables of frequency revealed that teachers who were older with more years of experience were less satisfied with how students had learned online in comparison with younger and less experienced teachers (see Table 2). Moreover,

teachers with fewer than 5 years of experience were more dissatisfied with online learning.

[INSERT TABLE ABOUT HERE]

Lower performance among online students was perceived by teachers without a preferred platform (80.3%) or those who used Webex (83.3%), WhatsApp (74.3%), or Google Meet (71.7%). Equal performance was more perceived by users of Skype (37.5%), and higher performance was more perceived by users of Zoom (13.5%).

The age group that obtained a better-perceived performance in online learning was secondary education (n = 296; 61%), and the age group that obtained a lower performance level was primary education (n = 262; 52%).

Teachers rated student satisfaction as very satisfied (n = 70; 14.4%), satisfied (n = 137; 28.2%), neither satisfied nor dissatisfied (n = 131; 27%), dissatisfied (n = 103; 21.2%), and very dissatisfied (n = 22; 9.1%). Chi-square analysis showed significant differences between student satisfaction and teachers' experience ($\chi 2 = 36.204$; $p = .015$), preferred videoconferencing platform ($\chi 2 = 48.819$; $p = .029$), and students' performance online ($\chi 2 = 72.567$; $p = .000$). Contingency tables revealed that:

- The more experienced were the teachers, the lower they rated student satisfaction (Table A1).
- Teachers with 20–30 years of experience had similar percentages from dissatisfied to very satisfied (Table A1).
- Skype and Zoom users regarded student satisfaction as satisfied and very satisfied higher than other platform users (Table A2) .
- The better the perceived students' performance, the better students' satisfaction and vice versa (Table A3).

However, students rated as very satisfied showed the same frequency across all students' performances. Tables A1, A2, and A3 are provided in the Appendix.

Discussion

This study examined the use of videoconferencing platforms in conservatories and music schools in Spain. Teachers responded to items related to the frequency of use, preferred platforms and reasons, advantages and disadvantages, change of perception in online teaching, student performance by age group, and perceived student satisfaction. Findings could have applications in future crises, emergency weather days, and specific health conditions of students or teachers. Also, results could be compared with previous distance education research to evaluate differences and similarities and find better solutions. Moreover, governments and institutions could take heed of this experience and revise curricula and provide educators with the necessary tools and knowledge to shift at any given moment from one format to the other.

Videoconferencing platform preferences

During the lockdown, most teachers were faced for the first time with the necessity of teaching online, without previous experience or tools. Only very few participants decided, at the time, not to use videoconferencing platforms and instead chose asynchronous teaching. This is probably because institutions recommended and encouraged this format to music educators (Ponce et al., 2022). After the lockdown, more than half of the participants continued to teach online. Reasons were related to temporal isolation of a student, health issues, student preferences, restrictions in the institutions, and also because of the benefits discovered in this format. The fact that 44 teachers had taught online before COVID-19 compared to only 62 teachers preferring blended learning over face-to-face lessons after COVID-19 reveals that most teachers

were probably uncomfortable with the necessary technology and unprepared for the change (Palau et al., 2020). The lack of support and specific hardware for both students and teachers may have been a ramification of this (Gassó, 2021). Teachers who already taught online would probably have had the resources and necessary knowledge to make the change with greater success. According to Spieker and Koren (2021), although teachers may be more prone to implement technology after being familiarized by it, the opposite may be true for those who had negative experiences. Nevertheless, the fact that a great number of participants changed their perception of online learning after the lockdown could mean a change in perspective for future experiences.

No relation was found between the preferred platform and the instrument taught. Many of the reasons given to justify the preference for a specific software were common across the different platforms available. For example, ease of use or audio and video quality were shared among most options. This, in turn, might suggest that factors such as performance and ease of use are subject to personal preference or specific hardware setups; to illustrate, some platforms might be better optimized for specific devices, such as tablets or mobile phones, affecting the performance experienced, depending on the equipment available for students and teachers. There are, however, some characteristics that are specific to each platform and valued by its users: Zoom's audio configuration options, WhatsApp's general availability, Google Meet's integration with Google Classroom, and Microsoft Teams' education tools. These results support Kesendere et al.'s (2020) findings that Zoom, Skye, and WhatsApp are the most used platforms to teach violin.

There is probably an additional bias related to the institutions' support for specific platforms. For example, each autonomous community has specific jurisdiction over educational institutions, such as conservatories. This is evidenced in the results:

that is. some autonomous communities had a preferred platform, and only conservatory teachers used Microsoft Teams and Webex. Since the pandemic, some videoconferencing software providers such as Webex have started to improve their audio options, giving the possibility of a music mode (Webex, 2021). The interest of software companies in improving their capabilities for music shows the potential of this format.

Very few teachers used only videoconferencing platforms for remote learning. Most complemented instruction with asynchronous methods to overcome the limitations of video calls. Asking students to record themselves was the most used resource, followed by teachers' recordings of themselves and videos from YouTube or similar platforms. Kesendere et al. (2020) mention the same resources for violin tuition and add the use of music notation software, score databases, and Spotify. Hash (2020) is much more specific (including frequencies and percentages) and reports a large use of learning management systems (e.g., Blackboard, Google Classroom) and music accompaniment software. Other less frequently used resources in Hash's study were collaborative platforms, audio editing software assessment platforms (e.g., Kahoot, Quizalize), and telephone calls. Given that Hash's sample consisted of school band teachers dealing with numerous students, it can logically be inferred that resources are more varied and group-centered, like learning management systems.

Perceptions of online teaching

Most teachers taught online only as a result of the restrictions imposed by COVID-19. However, some observed benefits in line with those reported repeatedly in the reviewed literature, such as teaching unconstrained by location or reductions in time and travel cost (Koutsoupidou, 2014). Participants described other less common benefits, such as students' improved performance and the possibility of recording the lessons. For

example, Respondent 168 said "[Recording themselves] contributes to a different awareness of their own performance, giving them the possibility of listening from outside." Another teacher said that "the positive outcome of the lockdown is that students have increased their self-criticism" (Respondent 24). Self- recording is a useful tool that has been often encouraged by teachers (Klickstein, 2014; Ku, 2018; Pearce, 2008), and since the pandemic, its use has become more common (Hash, 2020; Koutsoupidou, 2014).

Difficulties of online teaching during the period of study were similar to what was described in pre-and post-COVID-19 literature (Bennett, 2010; Blackburn & Comeau et al., 2019; Dammers, 2009; Hewitt, 2020; King et al., 2019; Kruse et al., 2013; Shoemaker &Van Stam, 2010; Stevens et al., 2019). Most teachers during the lessons experienced the problems of audio, video, and connection quality, the impossibility of playing together, difficulty in correcting posture and technique, and latency. The challenge of maintaining concentration in students was more often reported by teachers who taught younger students (primary and infant education) and the retired. Motivating students in online environments is demanding and often entails an extra effort in redesigning pedagogical approaches (Ng et al., 2022). A strong relationship between teacher and student is also a crucial factor in promoting students' engagement (Mac Domhnaill et al., 2021). In pre-COVID-19 literature, the social-constructivist approach where students learn through interactive and social exchanges has proven a promising methodology (Azhari et al., 2020; Bryant & Bates, 2015; Johnson, 2017; Lock & Johnson, 2018).

In the survey, teachers commented that the most problematic drawbacks were those inherent to videoconferencing hardware and software:

> In instrumental teaching, so sensitive in many technical and performative aspects, it is nearly impossible to teach more than the purely mechanical and rhythmic even knowing the characteristics of the students beforehand. Also, face-to-face interaction (especially in the early years) is fundamental in teaching. (Respondent 190, violin)

> The low quality of sound in videoconferencing communication or recordings makes it impossible to teach dynamics and timbre, a fundamental part of our pedagogy, in a satisfactory way. (Respondent 186, piano)

> I invested in recording material, microphones, etc., to set a good example for students, but the sound quality returned is very low. There is interference and cuts in the sound, the room is often too small and they can't play far enough from the music stand. (Respondent 224, oboe)

These difficulties probably had a great impact on the belief that students learned less with online lessons. According to Gassó (2021), results would possibly be different if students and teachers had been provided with the necessary equipment. Age and years of experience in teaching also affected the perception of student learning since teachers with more teaching experience are generally more reluctant to change (Hamlaoui, 2021) and have less technology proficiency (Inan & Lowther, 2010). Also, teachers with fewer than 5 years of experience were more dissatisfied with online learning, maybe due to the lack of experience and confidence expected from junior teachers (Klassen, 2010). Apart from technology, the pedagogical approach of teachers where traditional methodologies may require additional institutional support to develop and sustain new innovative pedagogies must also be taken into account (Johnson, 2017).

Surprisingly, the preferred videoconferencing platform was found to be a factor that influenced perceived students' performance. Teachers using Zoom tended to believe the students learned more, maybe because audio configuration helped perceive better the sound, regardless of the instrument. Users of Skype opined that the students'

performance was equal to face-to-face learning. Respondent 362 preferred Skype "because it does not modify volumes automatically, something indispensable in tuba. With the electric bass, I prefer Zoom (more modern and better interface)". Respondent 244 also preferred Skype "because of the timbre of the instrument (violoncello). There was not too much saturation in the lower frequencies". Although tests have not shown statistical differences between the preferred platform and instrument, the timbre and pitch of the instrument could be important when choosing a platform (Martínez-Hernández, 2021). Often, internet connection and servers affect the sound and video quality, and different platforms will work better in different situations and for different students. Respondent 233 said, "sound quality was good, although I could not evaluate if it was because of the platform [FaceTime] or the internet connection". Interestingly, those who did not have a preferred platform perceived lower performance in students. Also, teachers who used Webex, WhatsApp, and Google Meet perceived that students had a lower performance. Both WhatsApp and Google Meet are specifically voice-aimed platforms designed to enhance voice frequencies and with no possibility of modifying the audio options. This reduces sound quality in frequencies other than the voice, making higher and lower notes difficult to perceive and thus reducing instruction quality. Arguably, the reason for choosing a platform over another can sometimes be the ease of access to a larger number of students instead of audio quality.

Teachers generally rated student satisfaction positively even if most teachers were uncomfortable with online lessons, they perceived their students were satisfied with how they had adapted to emergency remote teaching. As with students' performance, those teachers with more experience rated students' satisfaction as lower, something which makes sense due to their reluctant to use technology. In relation to videoconferencing preferences, Skype and Zoom users rated student satisfaction higher

than other platform users. Coupled with the results of perceived students' performance, it could be concluded that, when selected as the preferred platform, both Zoom and Skype are more efficient in the learning-teaching process than other software.

It is surprising to find that students perceived as very satisfied showed the same frequency across all students' performances. This may be attributed to the fact that teachers not only considered the tools used or students' performance results but also their teaching skills, adaptation to emergency teaching, and students' feedback (Asoodar et al., 2016).

According to teachers, the age group that obtained a better performance was secondary education, and the age group that obtained a lower performance level was primary education. One of the reasons was that younger students needed parents' assistance when handling technological devices and connecting with teachers. Many teachers chose WhatsApp to facilitate this communication: "all my students (or parents) had it and used it habitually" (Respondent 136), "it was easier for me and students or parents" (Respondent 413), "easy and quick" (Respondent 155). Other reasons would relate to issues that have not been possible to study in this research, such as students' attention span according to age, motivation, and auto-regulation.

Conclusions

As shown by the Literature review, there have been many studies on online music education, but it was not until the lockdown that this format had to be implemented worldwide. Since then, significant efforts have been made to understand how teachers and students have dealt with emergency remote learning. In this study, results show that most participants preferred face-to-face lessons before and after the lockdown. Most teachers used videoconferencing platforms in combination with other asynchronous methods, especially recordings, to enhance learning. Zoom, Skype, Google Meet, and

WhatsApp were the most frequently used, while Zoom and Skype obtained better students' satisfaction and performance results. Also, teachers' perception of both students' performance and satisfaction was affected by the years of teaching experience.

However, the findings of the study should be interpreted with caution due to its limitations. First, findings are specific to conservatories and music schools in Spain; they do not reflect the use of platforms of many private teachers, who probably had more liberty selecting a preferred platform or had the pressure of losing students. Besides, those participants who did not use videoconferencing platforms during lockdown may have not wanted to complete the survey. Finally, the small effect sizes for inferential statistics could suggest that the significant correlations found would be the result of the sample size rather than real associations.

Future research should ponder how recordings have complemented synchronous teaching or which pedagogical approaches have helped students' engagement in emergency online instrumental learning. It would also be interesting to compare pedagogical approaches of institutions and teachers that have implemented online learning for years with the solutions adopted during the COVID-19 lockdown.

This study adds to the emerging literature evaluating the use of digital resources in remote teaching for music instrumental education. Videoconferencing software can be a key tool for providing quality online education, especially in instrumental education, where details are important. To achieve this, it is important to provide the necessary means and specific teacher training.

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Disclosure statement

No potential conflict of interest was declared by the author.

Notes on contributor

Ana Martínez Hernández, PhD in musicology, is a professor in the Music and Infant Education departments in the universities CES Don Bosco and La Salle Centro Universitario. She teaches subjects related to music education in the infants and primary bachelor degrees.

ORCID

Ana Martínez Hernández https://orcid.org/0000-0003-2208-9416

Data availability statement

The data that support the findings of this study are available from the author upon reasonable request.

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Tables

Table 1. Platforms used and preferred by teachers.

Platform	Users		Preferred platforms		Preferred by users
	n	%	*n*	%	%
Skype	275	56.7	98	20.2	35.6
Zoom	286	59	110	22.9	38.5
Meet	254	52.4	99	20.4	39
WhatsApp	227	46.8	35	7.2	15.4
Google Hangouts	67	13.8	2	0.4	3
Teams	92	19	34	7	37
FaceTime	63	13	16	3.3	25.4
Webex	31	6.4	6	1.2	19.4
Whereby	12	2.5	1	0.2	8.3
Jitsi	14	2.9	2	0.4	14.3
Google Duo	9	1.9	1	0.2	11.1
Discord	4	0.8	1	0.2	25
Telegram	2	0.4	0	0	0
Play with a Pro	1	0.2	1	0.2	100
Messenger	2	0.4	0	0	0
GoToMeeting	1	0.2	0	0	0
8x8	1	0.2	0	0	0
No preference			78	16.1	

Table 2. Contingency table years of teaching practice* students' performance.

Years of teaching experience	Students' Performance					
	Lower		Same		Higher	
	n	%	n	%	n	%
Less than 5	22	71,0%	6	19,4%	3	9,7%
5–9	24	55,8%	15	34,9%	4	9,3%
10–14	49	59,0%	24	28,9%	10	12,0%
15–19	42	59,2%	24	33,8%	5	7,0%
20–30	115	69,3%	36	21,7%	15	9,0%
More than 30	73	80,2%	10	11,0%	8	8,8%

Figures

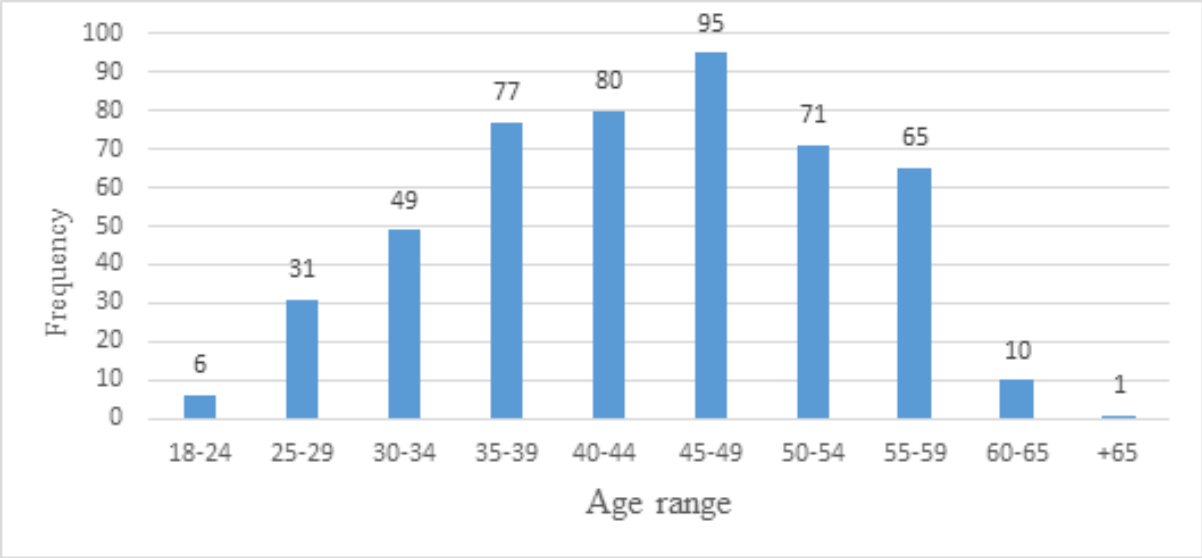

Figure 1. Age range of participants.

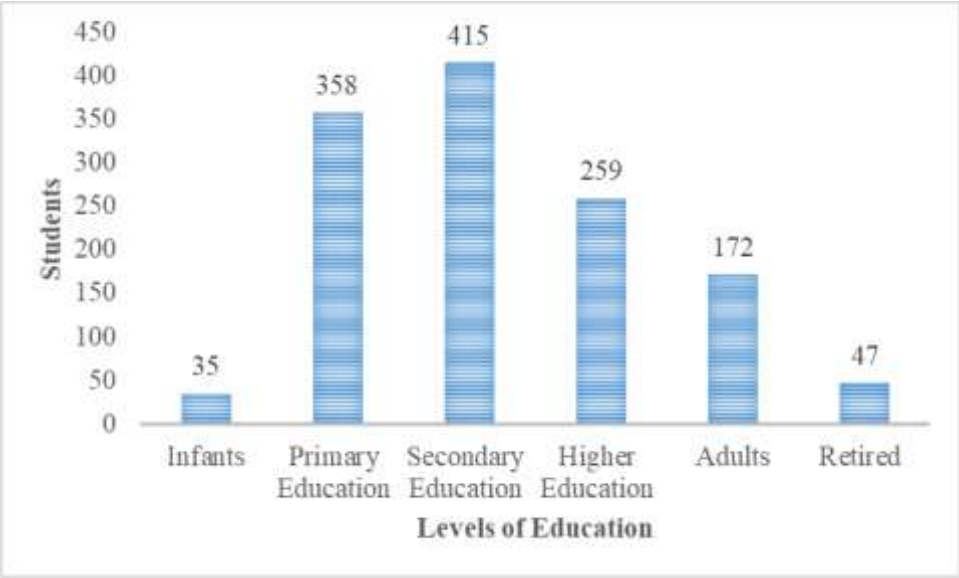

Figure 2. Levels of students' education.

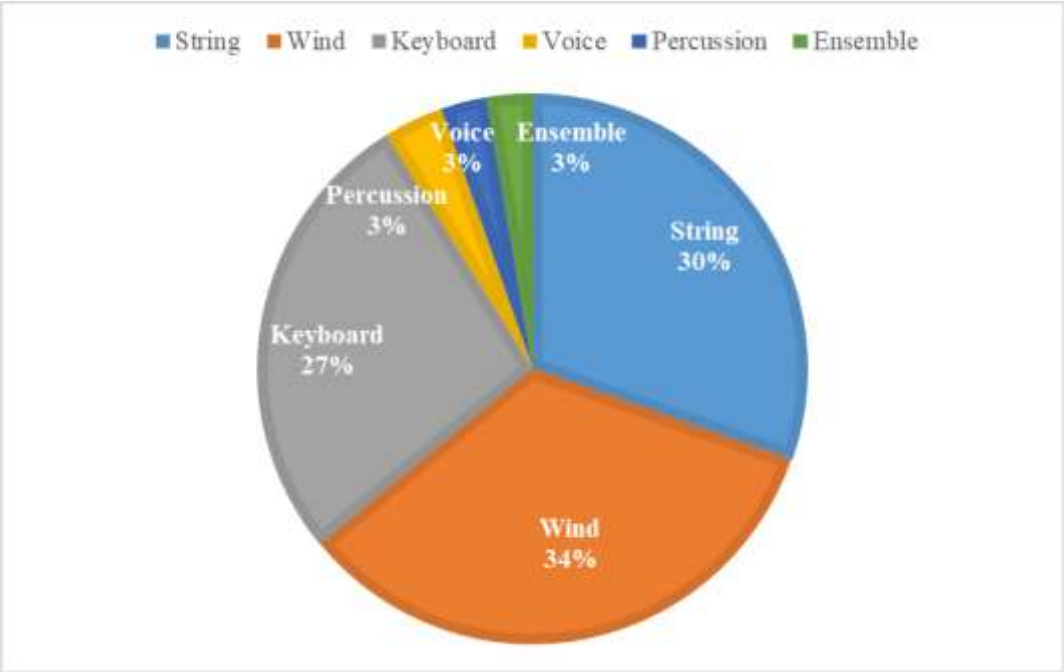

Figure 3. Instruments taught by participants.

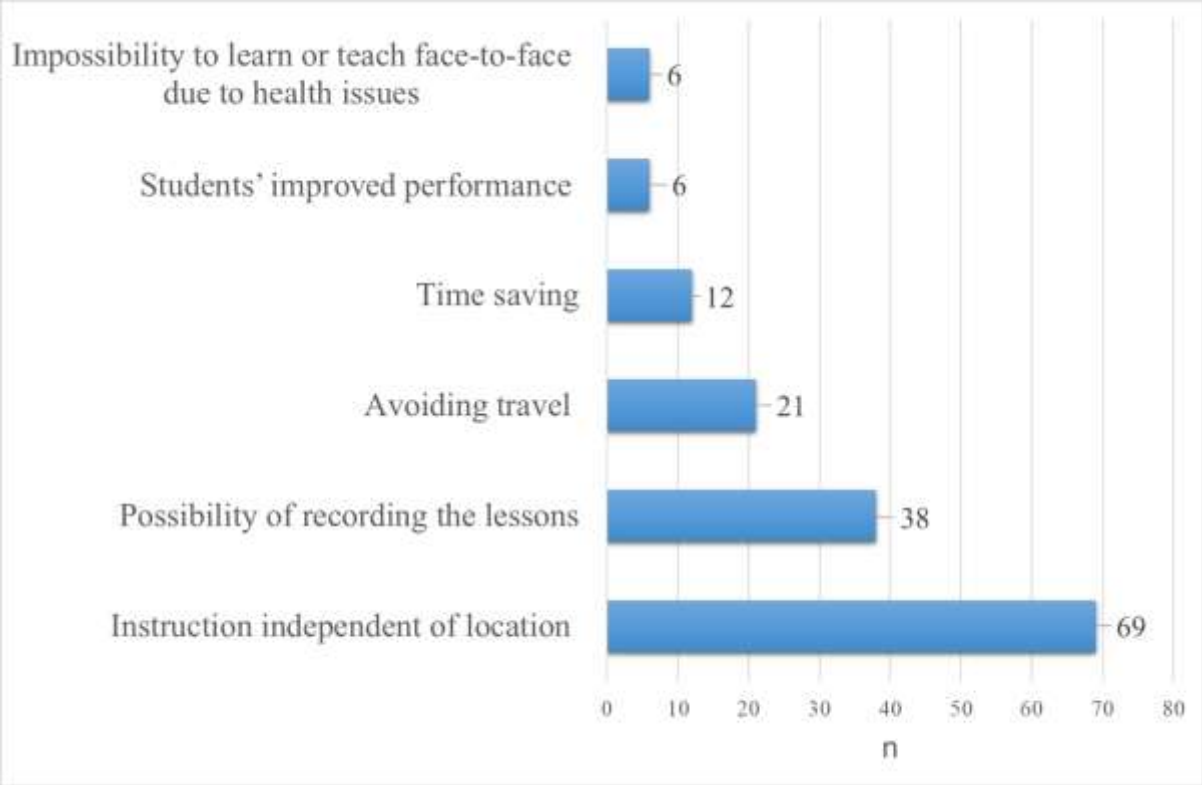

Figure 4. Reasons for using videoconferencing software.

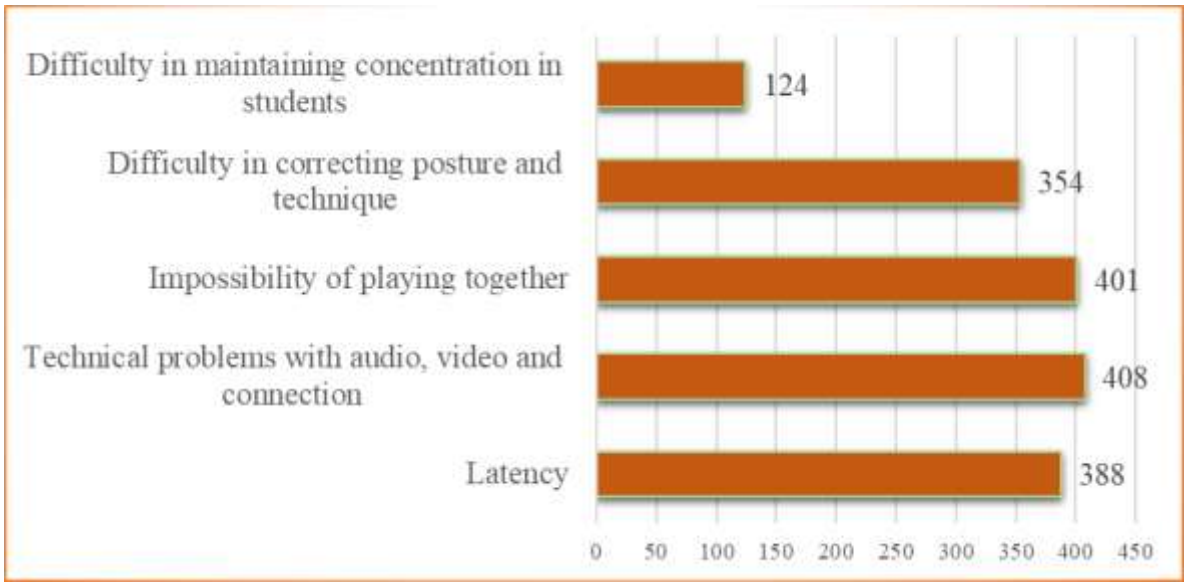

Figure 5. Drawbacks of using videoconferencing software.

Appendix

Table A1. Contingency table years of teaching experience*student satisfaction.

Years of teaching experience	Student Satisfaction									
	Very Dissatisfied		Dissatisfied		Neither		Satisfied		Very Satisfied	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Less than 5	1	2,3%	9	8,7%	12	9,2%	6	4,4%	3	4,3%
5 - 9	1	2,3%	5	4,9%	9	6,9%	17	12,4%	11	15,7%
10 - 14	9	20,5%	12	11,7%	21	16,0%	25	18,2%	16	22,9%
15 - 19	3	6,8%	17	16,5%	18	13,7%	24	17,5%	9	12,9%
20 - 30	14	31,8%	35	34,0%	52	39,7%	42	30,7%	23	32,9%
More than 30	16	36,4%	25	24,3%	19	14,5%	23	16,8%	8	11,4%
Total	44	100%	103	100%	131	100%	137	100%	70	100%

Table A2. Contingency table student satisfaction*videoconferencing platforms.

Student satisfaction	Videoconferencing platforms																	
	No preference		Skype		Zoom		Meet		WhatsApp		FaceTime		Webex		Teams		others	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Very dissatisfied	10	13,2%	8	8,2%	15	13,5%	7	7,1%	1	2,9%	1	6,3%	0	0,0%	2	5,9%	0	0,0%
dissatisfied	23	30,3%	14	14,3%	17	15,3%	27	27,3%	7	20,0%	3	18,8%	4	66,7%	6	17,6%	2	20,0%
Neither	27	35,5%	20	20,4%	29	26,1%	30	30,3%	9	25,7%	4	25,0%	1	16,7%	8	23,5%	3	30,0%
Satisfied	12	15,8%	36	36,7%	31	27,9%	26	26,3%	10	28,6%	5	31,3%	0	0,0%	13	38,2%	4	40,0%
Very satisfied	4	5,3%	20	20,4%	19	17,1%	9	9,1%	8	22,9%	3	18,8%	1	16,7%	5	14,7%	1	10,0%
Total	76	100%	98	100%	111	100%	99	100%	35	100%	16	100%	6	100%	34	100%	10	100%

Table A3. Contingency table students' performance*students' satisfaction.

Students' Performance	Students' Satisfaction									
	Very Dissatisfied		Dissatisfied		Neither		Satisfied		Very Dissatisfied	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Lower	30	68,2%	82	79,6%	106	80,9%	82	59,9%	25	35,7%
Same	10	22,7%	20	19,4%	21	16,0%	40	29,2%	24	34,3%
Higher	4	9,1%	1	1,0%	4	3,1%	15	10,9%	21	30,0%
Total	44	100,0%	103	100,0%	131	100,0%	137	100,0%	70	100,0%