Title: Connect Resound: Using online technology to deliver music education to remote communities

Authors: Dr Andrew King, Dr Helen Prior (University of Hull), and Dr Caroline Waddington-Jones (University of York)

Abstract
This paper describes an action research project that aimed to widen participation for music education in school in England (UK). The Connect Resound project involved a pilot stage in North Yorkshire (England, UK) followed by a roll-out to four further geographical regions of England: Cumbria; Durham/Darlington; East Riding of Yorkshire; and Cornwall. The project involved testing a technological framework created to bring music education to schools with little or no music instrumental lessons within primary schools at key stage 2 (pupils aged 7-11 years). The pilot and roll-out phases refined the approach and established a business case for a grant to roll out the project nationally in 2017. The approach used in the study provided not only the instrumental lessons but also continuing professional development for teachers, on demand technical support, and access to music performances and masterclasses. The research team designed and tested several scenarios for using technology in this environment some of which were using single cameras and others that used a multi-camera setup. One of the approaches used technology to allow the teachers and pupils access to different camera angles and high quality audio to deliver the lessons which proved beneficial. The project team captured both video data as well as interviews and questionnaires with participants in order to better understand and refine the approach developed. This paper reports upon the challenges and opportunities provided by the project in terms of the technology and environment, an evaluation using a case study approach of how the teachers used the technology, and feedback in the form of questionnaires from pupils and parents/carers concerning the lessons. Issues around the technology concerned time lag, initial technical problems, and background noise in the teaching environment amplified by the technology. The different camera angles adopted in the project proved valuable for teachers, potential issues with assembling and tuning instruments were considered, and beginner technique could be demonstrated using this approach.

Keywords: Online learning; music education; instrumental teaching; music pedagogy

1.0 Introduction

Using online technology to support learning is not a new concept and has been used widely both within music education and other academic disciplines. The focus of the research in this domain has involved not only the specific technological developments but also the content and the frameworks that exist to enable these innovations. Gall (2017) draws attention to TPACK (Technological Pedagogical Content Knowledge) within the area of music teacher education and research conducted in this area. The TPCK approach draws upon PCK (Pedagogical Content Knowledge) introduced by Shulman (1987) which is a taxonomy created to classify '...the types of comprehension required of teachers for promoting student learning' (Gall, 2017, p. 307). The development of this model to include technology

(Pierson, 2001) responded to the demands of the introduction of computer-based learning in education more generally, which recognised the influence of technology and the need to view this as a separate strand within development work for pedagogical study. The Connect Resound project attempted to recycle existing technology to create a means of providing music education to remote rural areas of England and therefore the focus of the project was upon: the technology deployed and its effectiveness; and the behaviours of the teachers and learners in this online environment. A previous paper (King et al, 2019) examined in detail the behaviours online and compared this to face-to-face lessons. The purpose of this paper is to examine the technological solution and the stages involved in testing this before the project was rolled out nationally in 2017.

2.0 Online Music Education

Johnson & Lamothe (2018) is one of the most recent domain specific texts that offers theoretical and practical advice to a broad audience in Higher Education (HE) world-wide on using online technology in music pedagogy. This volume offers a comprehensive framework for implementing the use of technology and addresses many of the key issues such as approaches to learning, learning management systems, and professional development relating to this activity. Although published after the Connect Resound project began in 2014 this would have been a useful resource to draw upon for this project since there are synergies between the approach used by the project team and the framework created to understand this area provided by Johnson and Lamothe. One of the strands of work within the project was around Continuing Professional Development (CPD) some highlighted by Leong (2007) as problematic for teachers in terms of integrating technology into the music curricula. In a large scale case study across Australia, Singapore, and Hong Kong Leong discovered that whilst technology was used, specifically relating more to ICT than music production, there was often little or no support for teachers in its use which was the cause of great concern. It therefore became important for the project team to embed this support for teachers engaging with the online lessons.

Laurillard (2001) in *Rethinking University Teaching* highlighted the issue of online learning and the concern that some approaches being adopted at the time amounted to nothing more than using computers as electronic page turners. Although a considerable amount of research has taken place since this much cited text was published it represented a view at the time after a considerable period of research and resource development aimed at bringing learning online, and how perhaps there was still much to be realised in the use of technology in a pedagogical context. Other authors such as Picciano (2016) examine the past, present, and (potential) future of networked online environments from a policy and practice perspective in an HE environment. It draws upon past use of such technologies and then presents potential scenarios in which technology may be used in HE pedagogy in future decades.

Bowman (2014) views online learning through the more specific lens of music learning by examining the foundations, frameworks and practices. It shares a similar premise as Picciano in framing the historical context, although from a musical perspective, and is perhaps more focussed upon current research with a focus upon accreditation and standards in part 1, before moving to more theoretical models in part 2, and then applied in the final part. These volumes appear within an area for which there are multiple texts about designing online learning such as *Essentials of Online Course Design* (Vai & Sosulski,

2015) and particular volumes aimed at the aforementioned TPACK approach by Niess (2019). For the Connect Resound study the team wanted to understand the challenges beyond the technology and examine the pedagogical usefulness of the approach.

In *Music Learning Today* (2014) Bauer puts forward different approaches, ideas, frameworks, and design ideas from an instructional perspective for digital pedagogy in music. TPACK is again featured within this text and the importance from a design of pedagogy with technology which is something that is returned to in *ICT in Music Education* (Bauer & Mito, 2017). What is clear from many of these texts is that they draw upon frameworks from other areas (such as TPACK) to help understand and create the environment for online learning that was not previously considered in depth. Finney and Burnard (2007) drew together a set of ideas around changing identities, specific classroom studies, and strategies (agents) for change in *Music Education with Digital Technology;* this was particularly considered from a strategic perspective in terms of collaborative technologies by Ruthmann (2007).

It is evident that using online approaches in music education is considered from both a domain specific context and also incorporating more theoretical models that can apply across multiple disciplines. The Connect Resound project was specifically targeted towards primary age (7-11 years) pupils to develop music education from the perspective of instrumental teaching, masterclasses, and engagement in musical events. The instruments taught in the study included: violin; clarinet; guitar; flute; saxophone; trumpet; and percussion. For the teachers involved there was a bespoke CPD sessions and online resources as well as on demand support for technical challenges.[1] The approach developed for both the regional and national pilots for the study was around: the technological framework; the music lessons; and the continuing professional development for the teachers involved.

Online instructional videos are one way for learners to develop musical skills and this approach has been examined by various academics. Ward (2019) explores through the lens of Irish Traditional Music the use of virtual pedagogies and the resources that have been developed. These resources include from a virtual perspective classrooms, sessions, and even the use of virtual reality and Ward provides an ethnographic account of these developments in this context. What is of particular interest in this article is the focus on the social experiences of this type of learning and how in the *Online Academy of Irish Music* (OAIM) there is an attempt to mimic this experience for learners. There is certainly virtue here in attempting to bring the tradition to a wider audience and how this largely aural approach to music-making could benefit from internet-based technologies. However, Ward also highlights the potential limits of the approach suggesting the challenges of considering both the musical and social aspects in an online environment. It could certainly be the case that this online environment would benefit from a blended approach using both face-to-face and internet-based resources, something that is highlighted through the residential courses that are on offer; something which Ward advocates strongly in terms of developing musicianship in this tradition.

[1] For more information see the project website: https://www.nymaz.org.uk/connectresound/about-connect-resound

The use of video streaming to deliver music education is also evident in Scotland through the work of Alan Cameron (2010). The challenges are similar to that of the OAIM in that access to expertise and the rural nature of both regions lends itself to an online approach. For Cameron it was a much more pragmatic need to deliver instrumental lessons since no alternative for pupils existed. There are resonances here with the Connect Resound project since access to music education was problematic for many of the schools and therefore pupils in the project. The face-to-face aspects of instrumental learning was also considered by the project team to be an important component, and the differences needed to be explored. King et al (2019) describes this aspect of the research from a teaching behaviours perspective; it was not necessarily the case of championing one approach above the other but exploring the differences and what lessons could be learnt.

Many other approaches have been used or scrutinised when considering online music pedagogy. Kruse & Veblen (2012) and Waldron (2012) also looked at the use of pre-recorded videos as a means of developing musicianship. What was interesting from these studies was the in-depth view of the target audience and the content of the lessons on offer. The pedagogical approach was also explored and the use of aural reinforcement, modelling, and prompts for learners used in the videos. Modelling was an aspect that was explored in King et al (2019) and was a difference in the initial pilot as tutors working online needed to demonstrate, or *model,* how to assemble unfamiliar instruments.

3.0 Method

The project pilot took place in North Yorkshire (see figure 1) before being rolled out nationally in England with four further music hubs taking part (Cornwall; Cumbria Durham/Darlington; East Riding of Yorkshire)[2] during the second stage. These areas were chosen because of the percentage of people living in rural locations and population density.

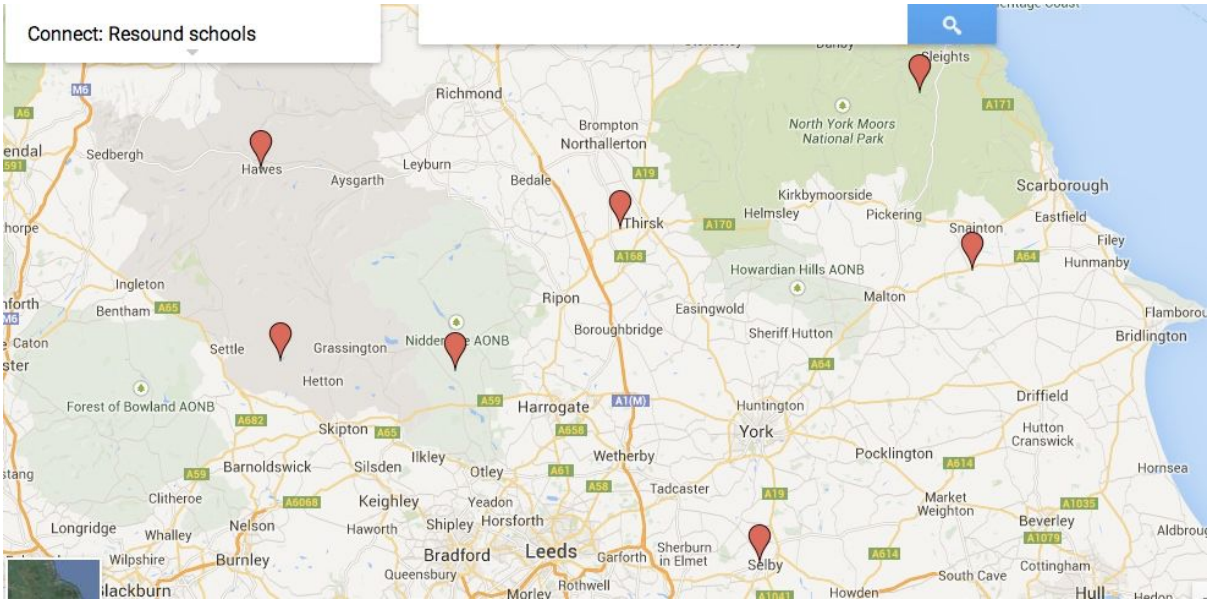

Figure 1: Location of participating schools in North Yorkshire pilot study.

[2] The percentage of people living in rural areas according to www.gov.uk: Cornwall 83%; Durham/Darlington 61%; East Riding of Yorkshire 60%; and Cumbria 54%. [accessed May 2017].

The research question was:

'How can existing video streaming technology be repurposed to deliver online instrumental lessons for learners in remote rural locations?'

The project piloted delivery for Music Education Hubs via video streaming in the following strands:

· Instrumental tuition
· Experiencing live music performances
· Continuing Professional Development (CPD) for staff

The project team identified a standard technical setup for all three strands of activity, comprising the Roland VR-3EX video and audio mixer and streamer, three cameras and external microphones. The equipment was used in addition to Skype, in order to maximise the quality of sound and image, and was sourced with best value as well as quality in mind. The team hoped to develop an approach which focussed on excellence of experience and learning for the young people undertaking distance learning of musical instruments whilst also being cost effective and within the reach of the education sector. During this phase different technological setups were used to see which was the most effective. The teachers were always based within the music hubs and a space was set aside in the participating schools for the lessons. The four technological scenarios tested were:

- Skype (school) to Skype (music hub);
- Skype (school) to Roland VR-3EX (music hub);
- Roland VR-3EX (school) to Skype (music hub); and
- Roland VR-3EX (school) to Roland VR-3EX (music hub).

The Skype to Skype lessons involved a single camera and inbuilt audio from the computer. The introduction of the Roland VR-3EX allowed for a three camera view of either the pupil, teacher, or both and included an enhanced audio microphone. Figure 2 below shows a typical setup in the classroom:

Figure 2: Group lesson using three cameras and microphone with Roland VR-3EX

There were 11 primary schools involved in the project (7 in the initial pilot and 4 in the roll out) with 110 key stage 2 school pupils (aged 9-11 years) and eleven trained specialist music instrumental teachers. For the project pilot each school selected a sample of 10 pupils four of which received individual lessons and the other six received groups lessons (2 groups of 3 students). The roll-out was less prescriptive and each school again chose 10 pupils however the size of the groups was determined by the teacher and not the research team.

The procedure for the study involved pre-project interviews with teachers to determine current use of technology, anticipated challenges, and to inform the CPD necessary to deliver the project. In the initial pilot in North Yorkshire the first and penultimate lessons were captured to understand how the use of the technology evolved, in the roll-out across the four regions one lesson was towards the end of the project. Post project interviews took place with all the teachers involved in the study and feedback questionnaires gathered from pupils and parents/carers.

The data collected for the study involved the video capture of the first and last lesson in each of the seven schools in the pilot and the capture of the penultimate lesson for each of the pupils in the roll-out; both video cameras and screen capture software were used. Each individual received a twenty minute lesson and each group thirty minutes over a seven week period. The reason why different approaches were used in stage 1 and stage 2 is because the research team wanted to investigate how the challenges presented during the first use of the technology and then subsequently how the teachers had adapted. For stage 2 the team wanted to examine a lesson in which the approach had become familiar. In addition, a control group receiving face-to-face lessons was also included but only relevant to the outcomes relating to teacher behaviour reported in King et al (2019). Pre- and post-project interviews took place with all music instrumental tutors and feedback in the form of questionnaires was gathered from all pupils in both stages of the study (89.4% returned) and parents/carers (50% returned). The feedback from pupils was administered after the last lesson which explains the high percentage of returns whilst feedback from parents and carers was administered by the schools involved in the project with the assistance of a member of the research team.

Ethical approval for the design of the study and the capture and use of the data was approved through the faculty research committee at the University of Hull. Ethical approval was sought from the parents/carers of the pupils involved in the study as well as all the music instrumental tutors and other participants interviewed for the project (such as music hub managers). All participants were given information sheets about the project before they agreed to take part.

4.0 Results

The results of the data analysis demonstrate three major areas of discovery for the research team:

- Technology;
- Delivery; and

- Environment.

The areas are not equally weighted in terms of significance but broadly speaking capture the essence of what was discovered by the research team.

4.1 Part 1 (technology)

The challenges concerning the use of the technology can be categorized as:

- Time lag: It is not possible to reliably count a steady beat for pupils to play along to. In addition, accompanying students was an issue. However, in-group lessons this was overcome by asking peers at the same location to provide a beat or an accompanying part;

- Technical problems: some lessons in the first lesson capture started late because of minor technical issues. However, all of the final lessons started on time suggesting these had been overcome.

In addition to what was discovered through video observations questionnaires were also given to all participants. 89.4% of pupils completed feedback questionnaires about the lessons. 67.3% of pupils said that sound quality was 'good' or 'very good'; 75.6% reported that they could hear what the teacher was saying 'most of the time' or 'all the time'. In post-project interviews, the peripatetic teachers provided a median score of 7/10 for sound quality. Specific sound-related challenges included noise spillage from adjacent areas in schools; the amplification of background noise in Skype; and reflections of sound in larger rooms. Headphones were sometimes reported to be problematic for younger children, particularly those with stringed instruments.

80.5% of pupils reported that the video quality was 'OK'; the same percentage of pupils reported being able to see what the teacher wanted them to do 'most of the time' or 'all the time'. Teachers gave a median score of 4/10 for video quality. Teachers' views of pupils were sometimes limited: they were not always able to see the whole of a pupil or a group of pupils, or to see the detail they required. This was alleviated somewhat by the Roland VR-3EX when it was employed at the school. Similarly, teachers using the device were able to show pupils closer views of specific parts of their instrument. Although the different camera views were not always explored fully in the first lessons, by the end of the set of lessons, teachers and pupils seemed to have established specific positions for cameras and switched between the different views easily.

The quality of the internet connection seemed to be variable: 51.2% of pupils described it as 'okay', with 22% ticking the 'Bad' category, 21.9% ticking the 'Good or 'Very good' categories. Teachers gave a median score of 5/10 for connection quality.

4.2 Part 2 (delivery)

In this section we will discuss the pedagogical implications of the project. First, we will highlight some of the main outcomes. Second, we will examine in detail three teachers and how they used the technology. In case studies 1 and 2 we examine individual lessons and in case study 3 group lessons are also included:

- Teachers often need to view the pupil as a whole;
- Difficulty teaching instrument technique with poor quality Skype connection;
- Assembling instruments could have been an issue;
- Tuning instruments;
- Technical problems with instruments;
- Beginner technique demonstrated well via online delivery; and
- Pupil distraction was not an issue.

The ability to switch camera angles or at least view the pupil as a whole was demonstrated as important to a successful lesson. Problems assembling instruments only arose for the clarinet teacher and this was remedied by establishing a written protocol for assembling the instrument that was sent to the school prior to the lesson. The online delivery required ownership for tuning the instrument at the start of the lesson to rest with the learner; this can be a challenge for beginners. However, free apps have been found that help students tune their musical instruments. The only issue concerning difficulties teaching technique arose from the 'Skype to Skype' method and this is one of the reasons this was dropped for the second cohort. Although the project was novel and this may have impacted upon the pupils' ability to concentrate all teachers agreed that pupil distraction was not a concern.

4.2.1 Case study 1

What figures 3a and 3b show (below) are the analysis of how the teachers used different camera angles during the first and last lesson. Category 8 is the camera angle of the overall view of the teacher. Category 6 is the close up camera angle and there was a further camera view (category 7; mid-range) that was not used at all. What can be seen between the two charts is that the teacher adapted their approach to teaching from the first to the final lesson. The percentage of close up camera view usage rose from 1 to 8% of the total lesson time and this was mainly used when the teacher was explaining points of technique to the learner.

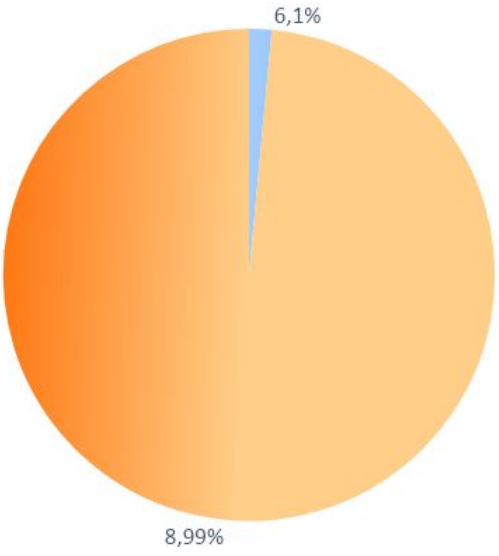

Figure 3a: Alison's first lesson (VR-3EX at both pupil and school locations).

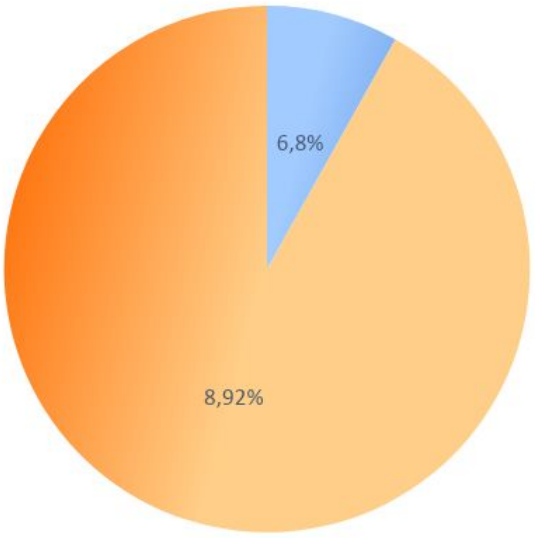

Figure 3b: Alison's last lesson (VR-3EX at both pupil and school locations).

4.2.2 Case study 2

Figures 4a and 4b (below) show the camera usage for a different teacher. The categories are the same as case study one. What is interesting about how this teacher adapted their approach is that whilst in the first lesson a variety of possible different camera views were used, by the final lesson they had adapted their approach to mainly using the overall camera view of the teacher and the close-up view to demonstrate points of technique. This shows a very similar type of use to the teacher analysed in case study one; the approaches appear to converge by the final lesson.

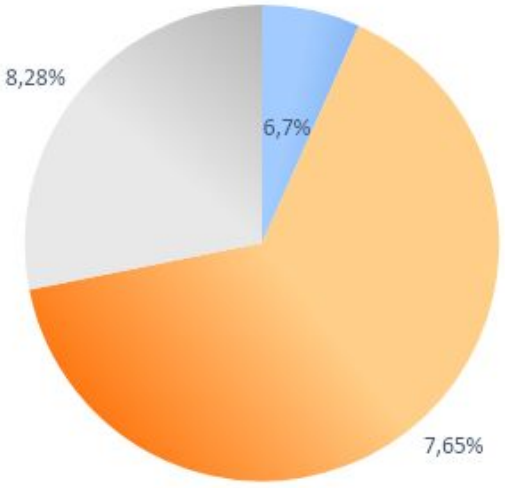

Figure 4a: Andy's first lesson (VR-3EX teacher location; Skype student location).

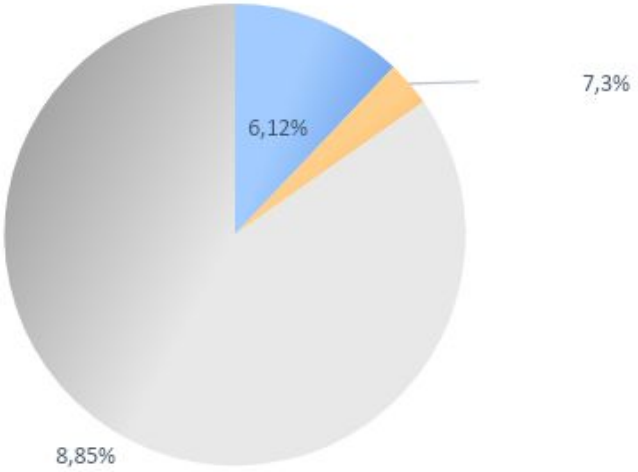

Figure 4b: Andy's last lesson (VR-3EX teacher location; Skype student location).

4.2.3 Case study 3

This case study demonstrates analysis of group lessons in which the VR3 is positioned at the students' location allowing flexibility in the use of camera angles. Category one in figure 5a and 5b shows the camera usage when one of the cameras is positioned on each of the group members. Category 4 is the use of three different camera angles on the same pupil. In the final lesson two further categories are added: camera on each pupil in group of two with side view camera added; and 3 two-camera views of one pupil and one camera on the other student. What this shows is how the teacher is adapting the camera use for group lessons by using different configurations of camera angles. This develops from the first lesson as the teacher considers the use of the technology more carefully and how to get the best out of it during the lesson.

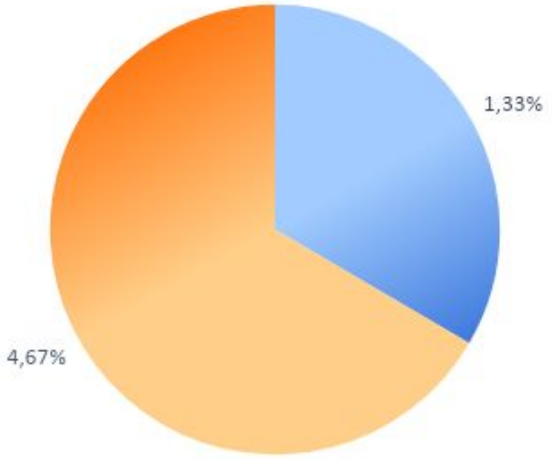

Figure 5a: Emma's first lesson (Skype teacher location; VR-3EX student location).

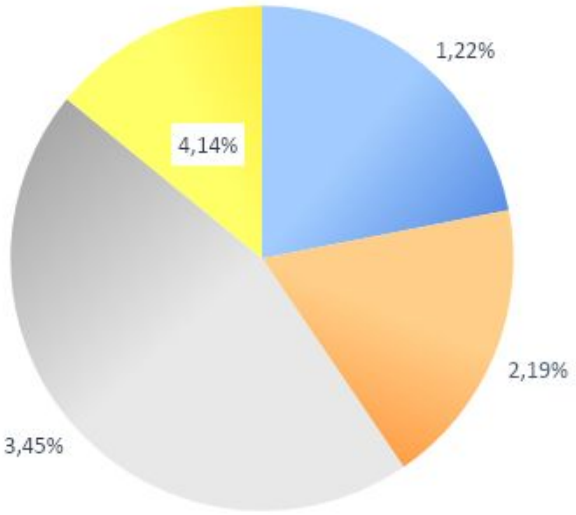

Figure 5b: Emma's first lesson (Skype teacher location; VR-3EX student location).

4.2.4 Interview data (teachers)

In initial pre project interviews, teachers had expressed concern about teaching children to assemble instruments; this proved to be largely unproblematic when a standard protocol was demonstrated to pupils. There were some problems tuning instruments; these were overcome with adult help and in some cases, the use of a tuning app. Few problems were reported in teaching beginner technique, though teaching bow hold was reported to be very challenging. The main challenge for all teachers was the inherent time-delay using Skype: teachers were unable to count a beat alongside a pupil playing. In group lessons, some teachers overcame this problem by asking children to count for one another. Providing a musical accompaniment for pupils was reported to be challenging.

Teachers reported that the pupils concentrated well, and all the children reported enjoying the lessons 'a bit', 'quite a lot' or 'very much', with 63.4% in the latter category. Parents' reports of their children's enjoyment were slightly lower (though the difference was not significant in a paired samples t-test), but still very positive. The vast majority of pupils (87.8%) reported practicing between lessons. Parents were slightly less positive about the amounts of practice, but the majority reported their children doing some practice between lessons. It is worth noting that lessons took place twice a week, allowing less time for practice between lessons than in standard weekly music lessons. Parents gave positive feedback about children's progress, and most of the children (65.9%) and many parents (46.3%) wanted them to continue to learn their instruments 'quite a lot' or 'very much'.

Face-to-face delivery was seen as preferable to online remote delivery by both children and their parents, but 39.0% of children and 29.2% of parents wanted the lessons to continue over the internet. The project did enable some children to receive a short period of music

lessons who would otherwise not have had this opportunity: 73.1% of parent respondents would not have sought out instrumental lessons for their child if this opportunity had not been available; 76.9% of parents reported that they had never previously sought out instrumental tuition for their child; and 52% of parents reported that their children had not previously received instrumental tuition.

4.3 Environment

There were a number of environmental issues that arose during the course of the video analysis and interviews. These can be broadly described as:

Rooms with multiple functions: some lessons took place in rooms that needed to be accessed by others during the session. This included using a photocopier and the room being a thoroughfare to other places in the school;

The size of the room: small rooms had issues with not being able to position the cameras far enough away (see figure 6) to fully see the pupil, whilst larger rooms had problems with reflections that caused a lessening of the quality of the audio; and

Noise spillage: lessons that took place during break time near playgrounds had problems with noise spillage onto the audio feed, and in addition noise from adjacent rooms to the teaching space caused concerns on occasion.

Figure 6: Example of small room use problem with fitting pupil into overall view

These rural schools are often challenged in terms of their size and the space that can be given over to this type of activity. However, by making schools aware of the issues surrounding this type of delivery it is anticipated that this type of distribution can be kept to a minimum. It is important to note that the rooms used for the online lessons would be the typical rooms used for face to face lessons.

5.0 Discussion

The project generally received a positive response from teachers, pupils, and head teachers that were involved in the project. In addition other spontaneous forms of feedback have been received from school governors:

'The children were engrossed in what they were doing… we are all very impressed with the concept… As a Governor I feel there are huge opportunities offered through the Internet for geographically remote schools, small schools with very limited budgets (like ours) and also for specialised teaching not just of music but of foreign languages… In short - brilliant project well executed.'

A School governor, Hawes CP School

Over 110 pupils benefitted across 11 different schools in association with five music hubs in geographical counties within England between 2014 and 2017. The project was rolled out to a further 7 music hubs in England and Wales since the national launch in 2017. Fifty delegates attended the inaugural gathering of educational professionals working with digital technology and the resources on the project website for teachers have been downloaded 863 times (as of March 2018). The live broadcasts and CPD events have also been viewed over 1200 times.

Although there were some technical issues during the project many of the more minor problems could be eradicated during the short trial period. The time lag for the audio stream presents an anticipated challenge but it this understanding of the team that applications are under development that minimise this and eradicate this problem. Rofe et al (2017) describe a major study in *Online Orchestration* that examines connection remote musical communities for telematic performance projects. The issue of time lag is highlighted here and pedagogical solutions suggested to overcome these challenges through using specially adapted scores. What has been discovered from a pedagogical perspective will inform future work and the development of support materials for teachers as a legacy arising from the project. The environmental challenges could be problematic for small rural schools since space can often be at a premium during the school day. However, by making teachers and schools aware of the potential challenges it is anticipated that the impact can at least be managed.

What was interesting about the case studies was the way in which teachers used the different camera angles during the lessons. The research team targeted both the first and penultimate lessons for video capture to understand both the initial issues and also how this could potentially change over time. The teachers in case studies 1 and 2 demonstrate this point in the project. In case study one the teacher highlighted in the pre-project interviews that the use of technology was a new concept for them and there were reservations and concerns about the challenges this would present. This is evident in the first lesson since there was little use of the different camera angles with the teaching preferring to mainly use the initial setup. For case study two the teacher was more confident with the technology and experimented with different camera angles and this is evident in the analysis of the first lesson in figure 4a. However, what was evident in the final lesson is that both teachers settled upon using the camera mainly with the overall image of the pupil with some use of the close up camera for demonstrating points concerning technique. Case study three was also particularly revealing because not only was this a group lesson but the teacher only had access to one camera at their location and multiple cameras within the classroom at the

school. It would appear the use of multiple camera angles developed over the course of the lessons and that a much broader use of the pupil views available was used which was different to the first two case studies that involved a single learner. The limitations of this project are that a longitudinal study of how teachers use the technology over a greater time period beyond the scope of the funded research would be necessary in order to understand how the teachers pedagogical approach developed and also to ascertain the attainment of the pupils involved in the online lessons. To reiterate an earlier point the purpose of the study was to bring music education to a pupils not currently engaged in music lessons and therefore widening participation in the arts more generally through technology.

The project has clearly been successful given the lessons were delivered and the feedback from stakeholders suggests this has been a welcome addition to music learning for the schools involved in the project. Although there are some differences in how teachers deliver lessons online what has been demonstrated is that they are able to adapt their approach to teaching to suit this particular medium. Four approaches were trialled during the project and the research team would initially recommend that schools and Music Hubs adopt:

- Skype (school) to Roland VR-3EX (Music service);
- Roland VR3 (school) to Roland VR-3EX (Music service).

What is also evident from the research is that a simple two-camera setup (one overall view of the teacher) would be an effective way to deliver the lesson. The camera views could then be switched from an overall view and a close up view with the latter used primarily for teaching elements of instrument technique. Although the cost of setting up the Roland V3R technology at the school location is relatively low it may still prove prohibitively expensive to schools on small budgets. It is therefore possible to suggest the use of Skype with an external webcam and microphone that could possibly deliver an effective lesson for learners. However, where it is possible that schools could invest in the technology the flexibility of having multiple camera angles (especially for group lessons) is clearly beneficial.

The music hubs could be delivering a greater number of online lessons from their geographical base and therefore the investment in the VR3 technology could prove more cost effective.[3] An important consideration for these hubs is the environment that the lessons are delivered from and to ensure a reasonable acoustic and a fibre optic broadband connection. If it were possible to setup a number of music hubs across the country in this way with these specialist facilities the music services have the potential to reach a greater number of pupils and widen access to music education for all. In 2017 funded by a major grant from Paul Hamlyn the project was made accessible to all music hubs in England.

Acknowledgements: The various stages of this project were made possible by funding from: The Nesta Digital Research and Design Fund (AHRC/Arts Council); Arts Council England; and The Paul Hamlyn Foundation.

References

Bauer, W.I. (2014). *Music Learning Today,* (New York: OUP)

[3] The report pertaining to the business case for the national roll-out can be accessed at: https://www.nymaz.org.uk/connectresound/about-connect-resound

Bauer, W.I. & Mito, H. (2017). 'ICT in Music Education', in *The Routledge Companion to Music, Technology, and Education,* King, A., Himonides, E. & Ruthmann S.A. (eds.) pp. 91-102, (New York: Routledge)

Bowman, J. (2014). *Online Learning in Music,* (New York: OUP)

Cameron, A. (2010). Instrumental music lessons delivered via video conference to remote schools in Scotland - (V & I Forum Pre-Conference). Paper presented at the Annual meeting of the ISME World Conference and Commission Seminars, China Conservatory of Music (CC) and Chinese National Convention Centre (CNCC). Beijing, China. Abstract available at http://citation.allacademic.com/meta/p397831_index.html

Gall, M. (2017). TPACK and Music Teacher Education, in *The Routledge Companion to Music, Technology, and Education,* King, A., Himonides, E. & Ruthmann S.A. (eds.) pp. 305-318, (New York: Routledge)

Johnson, C. & Lamothe, V.C. (2018). *Pedagogy Development for Teaching Online Music,* (Hershey PA: IGI Global)

King, A., Prior, H.P. & Waddington-Jones, C. (2019). 'Exploring teachers' and pupils' behaviour in online and face-to-face lessons, in *Music, Education, Research,* 29 (2), pp. 197-201, https://doi.org/10.1080/14613808.2019.1585791

Kruse, N. B., & Veblen, K. K. (2012). Music teaching and learning online: Considering YouTube instructional videos. *Journal of Music, Technology and Education, 5*(1), 77-87. https://doi.org/10.1386/jmte.5.1.77_1

Laurillard, D. (2001). *Rethinking University Teaching: a conversational framework for the effective use of learning technologies,* (New York: Routledge)

Leong, S. (2007). 'Strategies for enabling curriculum reform: lessons from Australia, Singapore, and Hong Kong, in *Music Education and Technology: Education and Digital Technology*, Finney, J. & Burnard, P. (eds.), pp. 181-195 (London: Bloomsbury)

Picciano, A.G. (2016). *Online Education Policy and Practice,* (New York: Routledge)

Rofe, M. & Federico, F. (2017). 'Telematic performance and the challenge of latency', in *The Journal of Music, Technology, and Education,* 10 (2/3), pp. 147-165, https://doi.org/10.1386/jmte.10.2-3.167_1

Ruthmann, S.A. (2007). Strategies for Supporting Music Learning Through Online Collaborative Technologies, In *Music Education and Technology: Education and Digital Technology*, Finney, J. & Burnard, P. (eds.), pp. 131-141 (London: Bloomsbury)

Shulman, L.S. (1987). 'Knowledge and teaching: foundations of the new reform', *Harvard Educational Review,* 57 (1), pp. 1-22

Vai, M. & Sosulski, K. *Essentials of online learning,* (New York: Routledge)

Waldron, J. (2012). Conceptual frameworks, theoretical models and the role of YouTube: Investigating informal music learning and teaching in online music community. *Journal of Music, Technology and Education, 4*(2-3), 189-200. https://doi.org/10.1386/jmte.4.23.189_1

Bios:

Dr Andrew King is Head of the School of the Arts at the University of Hull (UK).. He has led major research projects funded by AHRC, the Arts Council, the Paul Hamlyn Foundation (via PRSF, Sound and Music) in the areas of online music education, psychological wellbeing and evaluating the impact of composer residencies. He is first editor of *The Routledge Companion to Music, Technology and Education* and *Music, Technology, Education: Critical Perspectives.* He has acted as external examiner at a number of universities and is Editor-in-Chief of the Journal of Music, Technology and Education.

Dr Helen Prior is a Lecturer in music at the University of Hull. Helen is a music psychologist with interests in music perception and emotion and music performance. She previously held a post-doctoral position with the Centre for Musical Performance as Creative Practice, at King's College, London. There, she worked in the Shaping Music in Performance research group, led by Daniel Leech-Wilkinson. She has co-edited two volumes entitled *Music and Familiarity* (2013) and *Music and Shape* (2017).

Dr Caroline Waddington-Jones is a Lecturer in music at the University of York. Her current research examines the perceived impact of various new music projects connected to Hull's City of Culture year on different communities in Hull. She also works as a professional clarinettist and SEN/D music practitioner and is co-editor of *Music and Empathy*.

Contact details:
School of the Arts
Cottingham Road
Hull
HU6 7RX
UK
Email; a.king@hull.ac.uk