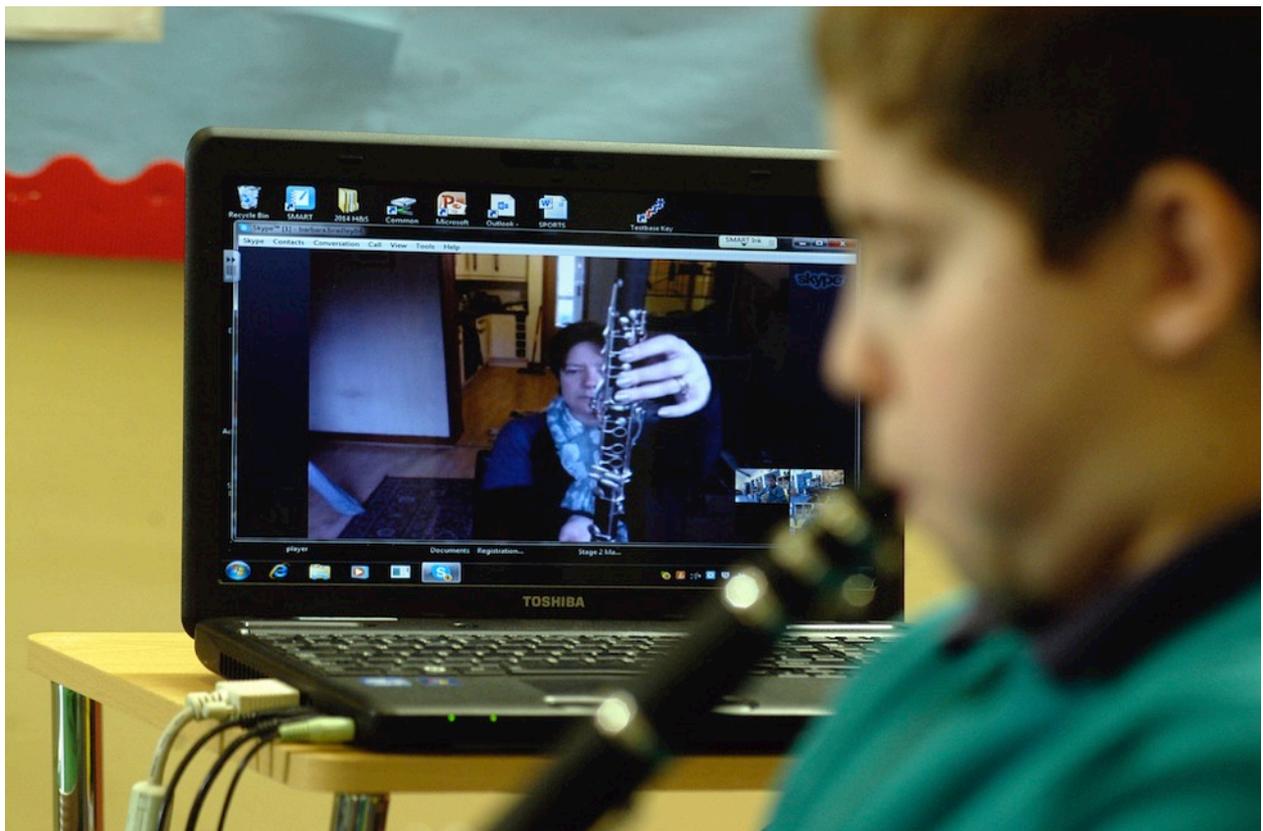# Hardware options for delivering online music education: a guide for teachers & music education hubs

Connect: Resound partners NYMAZ and UCan Play have been working with Music Education Hubs and arts organisations to develop and explore approaches to teaching music online since 2014.

Throughout this time we have researched, tested and implemented a range of approaches to the teaching of musical instruments online and streaming live musical events.

The interest in online music tuition has been building steadily, and has become particularly acute since the onset of the COVID-19 crisis as the sector has sought urgent advice on how to move their work online.

This guide draws together some of our learning from the past five years to provide specific advice on the hardware options that can help you to maximise the quality of your online music education provision.

Contents

With warm thanks to our technology partner for drafting this guidance:
Dr Jonathan Savage, Managing Director, UCan Play
jonathan@ucanplay.org.uk, www.ucanplay.org.uk

Find more free resources on online music tuition at:
www.connectresound.org.uk/resources

1   Software: Platforms for online instrumental lessons

There are many options to consider. Music Education Hubs and arts organisations taking part in the Connect: Resound project have chosen different platforms depending on their particular needs and circumstances, including Skype, Skype for Business, Google Hangouts and Zoom, as well as bespoke platforms used within the education and/or music sectors.

All rely on the technical infrastructure of a standard PC or laptop, i.e. microphone, speaker and the opportunities offered within the software itself.

Whichever platform you choose, please remember two things. Firstly, consider safeguarding issues associated within this type of instruction. These are detailed within the Connect: Resound safeguarding guide - available free from **www.connectresound.org.uk/resources**, which also compares some of the key features of the various platforms available, and notes that the free versions of these platforms are unlikely to meet the safeguarding and privacy requirements that you may need to deliver regular lessons.

Secondly, think about the wider context within which the software sits. You/your organisation may have its own website, content management system or student database (or all three). In terms of administration, consider whether or not you want individual teachers to be setting up online meetings, monitoring attendance, feeding back data to administrators responsible for invoices, etc.

There are ways to take away some of the stress of managing and administering the online space. For example, virtual rooms can be established, designated and monitored easily by administrators, thereby allowing the teachers to teach, the students to learn and parents to get the right impression of you/your organisation as (a group of) professional music educator(s).

2   Hardware: The basics

Using a tablet or mobile phone for regular online lessons is unlikely to be satisfactory - a desktop or laptop PC will usually be required.

PC
Regarding PCs, our friends at Your Space Music Lessons (www.yourspacemusiclessons.com) advise their teachers as follows:

- If using a basic internal webcam or single external camera, a laptop is preferable as you can adjust the angle of your webcam
- The Operating System needs to be compatible with video conferencing software
- Processor:
    - Minimum Single Core 1Ghz or higher
    - Dual Core 2Ghz or Higher (i3/i5/i7 or AMD equivalent)
    - Quad Core recommended for high quality screen sharing
- RAM: 4GB recommended

Screen size
The larger the better, and you may want to consider an additional screen to get a better view of the pupil

Other peripherals to consider
- Headphones to reduce feedback
- Remote mouse
- Multi USB port to accommodate external devices (depending on other hardware choices - see sections 3 & 4)

Next steps
Basic online instrumental lessons can be offered within software environments like those discussed above. However, additional technologies can improve production value and significantly enhance the student experience. Connect: Resound has explored these in relation to video and audio technologies, as discussed below.

3   Hardware: Video

Getting started
A low-cost way of improving the video experience is to consider an external HD webcam - this is likely to be a better option than a fixed camera in a laptop or tablet.

Within most software you can switch between the internal and external webcams during a live session. This can offer the student two alternative viewpoints. Although this is not a particularly elegant solution, it is a good way of getting started.

There are numerous brands and types of webcam. As with most things, you tend to get what you pay for. Our friends at Your Space Music Lessons regularly advise their teachers and students on webcam choices and recommend:

- A wide angle
- At least 30fps
- HD cam 1080P resolution
- e.g. Logitech C920

Stepping up
There are significant opportunities to create a richer, immersive environment through multi-camera systems built around technologies such as Roland's VR-1HD (https://proav.roland.com/global/products/vr-1hd/) and VR-4HD (https://proav.roland.com/global/products/vr-4hd/).

The VR-1HD offers users the chance to connect three HD cameras and two microphones together to create a richer, studio-type environment for broadcast. The VR-4HD extends this to four cameras and six microphones, and offers a range of other features that might become useful for those wanting to take live-streaming to the highest level.

The multiple cameras that can be attached to both the VR-1HD and VR-4HD allow the pupil a variety of angles and views of the teacher and their instrument. In the research reports published by Connect: Resound you can explore in depth how teachers have explored the way in which

camera placements can be set up in relation to specific instruments, providing students with greater insights into technical aspects of learning an instrument alongside a standard teacher 'head and shoulders' perspective. See www.connectresound.org.uk/resources for more details.

Considerations

When setting up the video side of your digital music classroom:

- Position the camera(s) carefully. Think about what you want the student to concentrate on during the specific lesson. If you only have one camera available, consider how it could be moved around at key points in the lesson.

- If you are in the fortunate position of using a video mixer like the VR-1HD, then where are you going to position your cameras and for what purpose? Think about the pedagogical approach here. What do you want the student to really focus deeply on? Position the cameras accordingly.

4   Hardware: Audio

Getting started

- If you are teaching an acoustic instrument, an entry level condenser microphone like the AKG C1000S is ideal (www.akg.com/Microphones/Condenser Microphones/C1000_S.html);

- With a little more budget, the Rode NT1A (www.rode.com/microphones/nt1-a) would also be suitable for home use, or perhaps a matched pair of Rode NT5 overhead mics (www.rode.com/microphones/nt5);

- All of these microphones will pick up your voice, but if you are wanting to move around a little then do consider purchasing a lapel microphone to help ensure even coverage

(www.akg.com/Microphones/Speech%20%2F%20Spoken%20Word%20Microphones/C417PP.html).

- If you wish to use a lapel microphone and an instrument microphone you'll need to buy an audio interface with at least two channels. Options here include the PreSonus Audiobox iTwo (www.presonus.com/products/AudioBox-itwo) or the Focusrite Scarlett 2i2 (https://focusrite.com/en/usb-audio-interface/scarlett/scarlett-2i2).

Stepping up

The Connect:Resound project has worked on the principle of a two channel approach: one lapel microphone for the teacher (the Rode Smart Lav+) and a Rode NT5 matched pair of condenser microphones for the instrumental sound in the room, which are then connected to a VR-1HD or VR4HD, as detailed in the video section above.

This set-up can be pared back to a basic audio interface such as the PreSonus AudioBox iOne (www.presonus.com/products/audiobox-ione) or Focusrite Scarlett Solo (https://focusrite.com/en/usb-audio-interface/scarlett/scarlett-solo)

The addition of a decent quality condenser microphone can transform the audio experience offered to students. The use of a digital audio interface is essential with such a microphone. Digital audio interfaces such as the PreSonus Audioxbox or Focusrite Scarlett ranges provide phantom power to the condenser microphone (no hunting around for batteries if the microphone provides that alternative power source) and also allow you to adjust the level of the signal coming into the computer. This is really important, particularly when you might be playing an instrument that is significantly louder than the sound of your voice.

So, check the levels carefully and the addition of a little compression and reverb can help, on occasions, to boost the quality. This can be done within the hardware settings of units like the VR-1HD and VR-4HD but would have to be done in computer software in other setups and this is not simple.

5   Production values

We know that our partners want to deliver instrumental music lessons at the very highest possible standard. We spend a lot of time (and money) making sure that our teachers are trained appropriately, have access to high quality CPD, and that the whole process of engagement with schools, parents and students is underpinned by high quality communication and materials.

All of these things are equally true in the arena of online learning. We understand that there is need to cover the bases quickly in the coming weeks. But we would encourage you to consider what 'quality' looks like in this activity. Here are some starting points for you to reflect on:

- Think about the physical environment for the live stream or recording. Is it clean and uncluttered? Does it enhance the overall experience from the student's perspective?

- Consider the lighting. Natural light is good but, generally speaking, don't point cameras directly at a window. If you can, avoid fluorescent lighting. Watch out for shadows and try and light the space from at least two sources where possible.

Finally, remember the key principles of instrumental music teaching. Teach music musically. Teach your instrument musically online. Demonstrate, model, play. Get the student doing things as soon as possible. Get them playing, whatever their level, as soon as possible. Whilst playing along together will be difficult due to audio latency issues on the internet, there are many fun games and alternative approaches that teachers have explored within Connect: Resound over the last four years. Learn from them. Read the case studies and ask us questions! Build on the work of those who have travelled this path before you.

6   Developing your online content

Do instrumental lessons always have to be delivered in real time, by one teacher to one student? Whilst this is the commercial model that underpins the work of many organisations, the present situation provides a good opportunity to challenge that orthodoxy and consider alternative methods. The good news is that our young people are used to learning things asynchronously in settings where the teacher is not necessarily 'live'.

For the delivery of instrumental music lessons, key questions might include:

- What content could be delivered by teachers asynchronously, i.e. without the student sat in front of you? For example, perhaps the more routine, repetitive elements of lessons could be covered in this way, e.g. how to play a particular scale, chord, or passage of a piece, thereby leaving a live lesson for those harder musical elements which are more difficult to define.

- If that is the case, how can technologies be used to create content that illustrates key lessons effectively? Digital production values come into play here. Think about the physical space of the digital recording, the camera angles, the quality of lighting and sound (as best you can within a typical home environment, perhaps).

- How can this new digital material be effectively curated and managed? We would encourage you to think about how a resource base of teaching materials that relate to your 1-2-1 teaching offer can be accessed by students 24/7. This would include hosting content on a website, organised appropriately. You Tube is ideal for this.

As our thinking moves towards alternative models of delivery beyond the traditional 1-2-1 approach, there are other more affordable

technologies such as Roland's Go: Livecast (www.roland.com/global/products/golivecast/) that come into play.

This unit allows you to use two smartphones and a dynamic/condenser microphone to live-stream via YouTube, Facebook Live, Twitch and other platforms. It doesn't connect to your computer so can't be used as an external webcam, and is operated by a free app.

As well as being an ideal tool for this 1-2-many approach to teaching and learning, it can also be set to a 'recording mode', which facilitates the production of video content via the two attached cameras (your phones) and microphone.

The Go: Livecast is a fraction of the cost of a Roland VR-1HD and VR-4HD and it facilitates a new approach to the teaching of musical instruments online. It will be interesting to see how our partners respond to this opportunity in the coming weeks and months.

As well as thinking about one to one online lessons (synchronous learning), do think about what digital resources you can create that enable you to reach a larger number of learners, for example through creating and uploading videos of particular techniques, practice advice, demonstrations and so on. Using the right technology can help you to produce really professional looking, creative resources without years of technical knowledge and training!

7   Summary

The costs of purchasing a VR-1HD or VR-4HD are significant. Few organisations or private teachers will have the funds to purchase these units for individual teachers to use in their home environments. But they are ideal tools for organisations aiming to become well-equipped centres for online learning.

They enable organisations to deliver high quality online lesson experiences as well as live broadcasts of performances and the creation of videos and vlogs. For online lessons from homes/multiple teaching sites, some of the more affordable solutions described above may be more appropriate. Here's a summary of the main setups and their pros and cons:

SET-UP	PROS & CONS
Computer with internal webcam	- Low cost - Accessible - Relatively poor visual and audio quality
Computer with internal webcam and audio interface (such as the PreSonus Audiobox iOne or Focusrite Scarlett Solo) plus condenser microphone (e.g. AKG C1000S)	- Entry level cost-wise - Improved quality - Single camera angle and basic video quality - Significantly better quality audio
Computer plus: Audio interface (such as the PreSonus Audiobox iOne or Focusrite Scarlett Solo) plus condenser microphone (e.g. AKG C1000S) External Webcam, e.g. Logitech webcam 930e plus a mini tripod	- Relatively low cost - Improved quality - Improved video quality & option of 2 camera viewpoints - Significantly better quality audio - Cameras need to be switched over within the video streaming software, which may distract from teaching

Computer with VR-1HD, cameras and microphones	- Mid-cost - Easy to use 3 video cameras 2 microphones - Range of in-built effects and transitions - No direct preview screen, so you will need to buy a mini-screen (with a HDMI connector) to view outputs and change settings
Computer with VR-4HD, cameras and microphones	- Top end in terms of cost - Easy to use 4 video cameras 6 microphones - Range of in-built effects and transitions - In-built screen makes previews easy and other settings are easily accessed and changed
Smartphone plus Go: Livecast	- Low cost - Two camera streaming - One microphone connection with phantom power (i.e. if want condenser microphone) - Not possible to connect to a computer as webcam, so no 2-way communication - Ideal for streaming one way - Highly portable - Recording option for the creation of digital content