# Sound recording: setting up a studio

KS3/4/5

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### Introduction

This is the first in a short series of resources looking at the different aspects of sound recording in schools. This initial article deals with setting up and equipping a new studio, and future resources will move on to pre-production and planning, and managing the recording session itself.

For the purposes of this resource, we'll focus on recording live instruments in as much of a studio-type environment as possible. This can be anything from a single instrumentalist to a rock band.

There can be a bewildering number of things to learn when you want to record something: the equipment you need, how it should be set up, and what to do after you've done your recording. A lot of this knowledge is built up over years of practice, but there are some basic concepts that you can use to make a convincingly professional-sounding recording with a limited budget in a school classroom.

We'll break all this down into a few areas. First, there's a glossary of terms that may come up in conjunction with setting up a recording studio, and that might be unfamiliar to the average teacher. You'll often find that if you look things up online or speak to someone in the recording business, they will use these terms, so it's useful to understand what they mean!

Second, we'll go through the main bits of equipment that you'll need for your studio. You may already have many of these items in your department, and a lot of good equipment is available second-hand, so it's worth having a look around to see what you can get your hands on.

The third step is to set up a room (or rooms) for a recording, and we'll also at how you might start to do this.

## Glossary of recording studio terms

| | |
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| Cans | Headphones. |
| Click/click track | Metronome track for the musicians to play to. |
| Multitrack | To record each instrument on a separate track, usually using overdubs (see below). |
| Overdub | To record an instrument on an existing recording usually on a separate track. |
| XLR | The connector used for microphones. |
| Jack | The connector used for most electric instruments (guitars, keyboards, etc). |
| Tracking | The process of recording instruments on separate tracks. It can happen all at once or one at a time (overdubbing – see above). |
| Digital | A recording system based on fixed numerical values (0s and 1s), eg computer-based recording, CD recording, digital tape recording (DAT, ADAT, etc). |
| Analogue | A recording system using a continuous electrical signal, eg traditional tape recorders. (The common comparison between analogue and digital is between vinyl and CDs.) |
| DAW | Digital audio workstation. This is the computer and software program used for the recording. |
| Drop in | To record something at a particular point in a recording, either to replace what's currently there, or to add to it. |
| Mixing desk | A device that allows different sound sources to be channelled and fed elsewhere, eg into a computer. |
| Outboard | External sound-processing units usually mounted in a rack unit. |
| DI Box | Direct injection box. A device that allows an instrument with a jack output (unbalanced) to be connected to a XLR connection (balanced). It can also adjust for input volume level and remove unwanted noise and hum. |
| Balanced/Unbalanced | A balanced cable is one that has three separate wires inside it (eg an XLR cable), allowing it to block out interference from other sources. An unbalanced cable (eg a guitar lead) has two wires and can be susceptible to interference from other sources (eg picking up radio). |
| Phantom power | A power source for condenser mics and DI Boxes, usually supplied by a mixing desk or audio interface. |
| Audio interface | The hardware that connects your sound sources (mics, etc) to your computer. A lot of modern mixing desks now have an audio interface built in. |
| DB | Decibels (a measurement of sound pressure levels). |
| On/off axis | When a sound source is straight in front of a mic (on) or angled to the side or behind (off). |
| In the box | Mixing a recording solely using the computer. |
| Monitors | Studio speakers. |
| Bit depth | A measure of how accurate the recording is. A higher bit depth will produce a more detailed recording. |
| Mono | One sound source. |
| Stereo | Two sound sources – creates the illusion of a wider sound stage. |
| Level | The amount of sound going into the mixing desk/audio interface. |
| Hertz | The unit of measurement for frequency. |
| Highs/mids/lows | General terms for different frequencies. |
| Gain | A term for the volume going into something, for example the input volume on a preamp. It's also common on guitar amplifiers on which it usually refers to overdrive/distortion. |
| Overdrive | The distorted sound that happens when an amplifier is overloaded. |
| Clipping | Similar to overdrive, but generally used more to describe distortion produce by too much level going into a mixing desk and/or DAW. |

## Equipment

### Which DAW?

Most professional recording set-ups consist of an Apple Mac computer running Logic or Pro Tools. It's possible to run Pro Tools on a PC but not Logic.

There are many other recording programs available, and all have strengths and weaknesses – Cubase, Ableton, GarageBand, Cubase and Cakewalk, to name just a few. We don't have space here to go through each program, but suffice to say that they all work in a similar way, and good results can be achieved using any of them.

There are, however, a few important things to consider:

1. Is your computer powerful enough to run the program, and is the operating system compatible? You should be able to find the suggested specs for each program and check whether your computer matches them. You may have to ask your IT department for advice in this matter. Some programs (for instance Pro Tools) may require their own audio interface, which will also have to be taken into account when planning the studio.
2. How will the computer integrate with my school's existing network? This is a very important issue, and one that has caused me no end of problems in the past! Recording programs make individual files of audio every time you record something, and these files can quickly take up a lot of space on your computer. For that reason, make sure you consult your IT department to see how this works in your school. Some schools will allow students to save their work on the computer's hard drive, but most will be set to save in the student's own space on a shared hard drive in the school, or a virtual space. These last two options can cause problems, since recording software is not usually set up to work this way, and will either fill up the student's space very quickly or will be too slow and cause the program not to work properly. In my experience, it's best to have one stand-alone computer that's used only for recording. Students can then use this computer when they want to record any bigger projects that are going to consist of a lot of audio files. If you have other music computers in the school, these can be used primarily for MIDI-based (virtual instrument) recordings that may have a small amount of audio.

### Which audio interface/mixing desk?

The commonest recording set-up found in schools used to be a mixing desk going into an audio interface plugged into a computer. With advances in technology, however, most mixing desks now have built-in audio interfaces, allowing them to be plugged straight into a computer. This is better for a lot of reasons: it saves on cost and space, and makes everything a lot simpler to understand.

For these reasons, I'd suggest going down this route if possible, as it will make your life a lot easier. You will need a desk with at least eight mic inputs, though I'd suggest you get 12 or 16 if your budget can stretch that far.

**Buying suggestion:** the Behringer Xenyx range of mixers are surprisingly good for the money, and offer a lot of different options and price points.

## Which microphone?

There are two main types of studio microphone, and both have strengths and weaknesses.

### Dynamic microphones

**Common models:** Shure SM58 and SM57.

Advantages:

- Cheap.
- Durable.
- Can withstand high volumes.
- Won't pick up as much background noise.
- Easy to use and don't require an external power source.

Disadvantages:

- Don't capture the same range of frequencies as condenser mics.
- Are less sensitive than condenser mics.

**Buying suggestion:** you can't go far wrong with the Shure SM58/57 combination. These are good for guitar amplifiers, drums and vocals, and are well made and should last a long time if taken care of.

### Condenser microphones

**Common models:** Neumann U87, Rode NT1.

There are two main types of condenser mics – large diaphragm and small diaphragm. Large-diaphragm condenser mics are usually used for vocals, on acoustic instruments, or as a room mic, and have a better signal-to-noise ratio than small-diaphragm mics. They are also significantly larger, with the capsule (the part that picks up the sound) mounted sideways on to the mic.

Small-diaphragm condenser mics have slightly better high-end frequency response in a smaller package. These mics are usually pen-shaped and have the capsule mounted on the end. Quite often sold in a pair, they are commonly used on acoustic instruments, as overheads on drumkits, and to stereo mic an instrument as a pair, for example a piano.

Advantages:

- Can capture a wide range of frequencies accurately and perform better than dynamic microphones. They are especially good with vocals and with acoustic instruments in general.
- They're superior to dynamic mics in capturing high frequencies.

Disadvantages:

- More fragile and not as durable as dynamic mics.
- Have to be mounted on a shock/specialist mount as susceptible to handling noise.
- Require an external power source (phantom power).
- Will pick up far more background noise than dynamic mics.

**Buying suggestions:**

- Large diaphragm: Rode NT1 – a great vocal mic often seen in professional studios, that comes with a shock mount and accessories.
- Small diaphragm : SE SE7 – a matched pair represents great value for a versatile and great-sounding mic.

**Microphone polar patterns**

- **Cardioid:** this type of mic picks up sounds from in front of the mic and rejects sounds from behind and to the side. It's great in live situations where you don't want to pick up any background noise.
- **Super-cardioid:** like a cardioid mic, but has better rejection of sounds from behind and to the side. This type of mic is even better in live situations and in the studio where you want to minimise background noise.
- **Bi-directional:** picks up sounds equally from front and back. This can be useful for recording two instruments sat facing each other with the mic in the middle, and can be used in lecture-type environments where you want to pick up the speaker on one side and the audience on the other.
- **Omni-directional:** picks up sounds equally from every direction. These mics are great placed in the middle of a room, capturing the sound of every instrument playing and giving the right live ambience to your recording.

## Which cables?

There are two main types of cable you will need, which are:

- **XLR cable:** these are used for connecting microphones or DI boxes to mixing desks or audio interfaces.
- **Jack-to-jack cable:** these are used for connecting instruments to amplifiers or DI boxes. They are also the standard cable for connecting most audio hardware together.

You'll need enough cabling for the mixing desk you have. In other words, a desk with eight mic inputs and four jack inputs will require at least eight XLR cables and four jack-to-jack leads. You will then need two cables for the monitors (usually XLR) and whatever cables are needed for the outboard equipment if you have any. It's always handy to have a couple of XLR adaptors that convert the male connector type to female and vice versa. You will also need a long USB cable to go from the mixing desk/audio interface to the computer.

**Buying suggestion:** for all cables, I would recommend Neutrik connectors, which should stand up to a lot more punishment than cheaper varieties. Buying cheap cables is a false economy, as they invariably break.

## Other equipment you'll need

- **DI boxes:** I'd suggest having two DI boxes as a minimum, to allow for one keyboard to plugged in, and one direct bass input.
- **Headphones:** you'll need good-quality closed-back headphones. It's imperative that they are closed back: if they're not, the sound will bleed through them and be picked up by microphones. **Buying suggestion:** AKG K52.
- **Headphone amp:** you'll need something to send the signal to all these headphones, and a headphone amp serves this purpose. One with two or more inputs is ideal, but one input will suffice if your budget is tight. This will probably go in the live room with the musicians, so shouldn't be put in a rack with the rest of the outboard (see below). **Buying suggestion:** Behringer HA8000.
- **A pop shield/filter:** these are generally inexpensive and are used to eliminate the plosive sounds made by the letters B and P that can ruin vocal recordings.
- **Monitor speakers:** you'll need a pair of monitor speakers to connect to the mixing desk, in order to listen to the recordings you've made and to mix the results. I'd always suggest buying powered monitors, otherwise you'll also need to buy a separate amplifier to power them. There are many monitor speakers, and the general rule is that the more you spend, the better and more accurate frequency response you will get. **Buying suggestion:** KRK RP5 G4.

**Outboard**

This is a large area, and for the purposes of school recordings, you do not necessarily need very much, if any at all. As most of these effects can be added 'in the box', these items are a bit of a luxury, but if budget permits, a good compressor/pre-amp can make things sound a lot more professional. These units are usually mounted in a rack unit to keep things tidy.

Common outboard includes:

- **Compressor:** a device for evening out the dynamic response of a sound. This is usually used to get a more even and consistent performance, but can also be used as an effect.
- **Pre-amps:** these essentially amplify the sound you put into them. In reality they can transform a dull, quiet sound into something far more dynamic and useable. Most have some kind of EQ and will colour the sound in a unique way.
- **Delays:** provide an echo effect.
- **Reverb:** provides a reverberation effect so that a sound appears as if it's been recorded in a different space, both in the type of room or building and its size.
- **EQ:** a device with sliders for each frequency band, enabling accurate adjustment of individual frequencies.
- **Limiter:** a device to limit the volume level of a sound source.
- **De-esser:** removes sibilance from vocal recordings.

## Recording set-up

Let's consider two different recording set-ups:

1. Control and live room (recording with the mixing desk and DAW in a separate room from the performance being recorded).
2. Live room only (recording with the mixing desk and DAW in the same room as the performance being recorded).

It's always ideal to have a control room and a live room. Most recording studios work this way, since it's very difficult to gauge the quality of sound being recorded if you're trying to monitor the sound in the same room that it's being recorded in.

With a separate control room, you can monitor the sound much more accurately and get a good idea of what the recording is sounding like as it's being recorded. It's also far more comfortable for the sound engineer to listen to the recording in a different room, rather than cowering behind a mixing desk while a band plays at full volume.

To set up a two-room studio, you will need more cabling in order to connect the rooms together. This would ideally be hardwired through the connecting wall using a wall box (on the live room side) and multicore cable (on the control room side), connecting the inputs and output connectors of the mixing desk to an identical set of connectors in the live room.

The multicore cable you get will need to have at least as many XLR sockets as your mixing desk has. I'd also suggest getting one with two or more stereo jack sockets for sending headphone signals from the control room to the live room. Wall boxes are usually sold empty and then wired in to fit the particular studio's needs. If you don't fancy getting your soldering iron out, I'd suggest buying a snake, which is a pre-wired wall box and multicore cable. If you can't make a hole in the wall to feed the cable though, you can always take it out through the door if you need to.

With the two-room set-up, the next big question is: can the person in the control room see into the live room so that they know what's going on? Ideally, there would be a large window linking the two rooms so that this can happen. This can be unpractical in a school, however, for many reasons, and it can be worked around as the engineer will have audio contact with the musicians, either through their headphones or a speaker of some type. The engineer will be able to hear the musicians talking through the mics set up in the room, but because they're usually quite low in volume (since they're often set up next to a drum or guitar amp), it's usually a good idea to have a talkback mic set up that can be used to speak to the engineer.

In a one-room set-up, a lot of what's been described above will be unnecessary. You do not need the snake, since everything should be close enough to run mics directly from the mixing desk, and there's no need for talkback mics. The main problem with the engineer being in the same room as the performers is that the only way they can monitor the sound being recorded is through headphones, which will be inaccurate, because the sound from the room will be too loud to distinguish from the headphone sound. For this reason, the engineer's job will be primarily to get the levels correct and operate the recording program.

## What next?

There's a lot to learn when it comes to sound recording, so I'd suggest you use this resource as a starting point for your own research. If it sounds unfamiliar and complex, don't be too worried: with a bit a logical thought and some trial and error, it's entirely possible to teach yourself how to get the best out of your equipment.

In the next article, we'll move onto what's sometimes called pre-production. This is everything you need to ensure your students do before they even think about recording. Recordings that are not planned properly take longer, and the results are invariably worse than recordings that have been planned carefully beforehand. With time a precious commodity in schools, it's imperative to make the most out of every recording session. From there, we'll later look at the recordings themselves, and how to set up the microphones and manage the session so that everything runs smoothly.