Sound Engineering with the Right Equipment

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Introduction

So, your modern band is to the point of needing some audio equipment a little more advanced than just running through guitar/bass amps and your vocals singing through a $20 karaoke machine? You have come to the right place! Profession Audio (PA) equipment can be a very confusing and in-depth area of your modern band. The goal of this handout is to provide you with some basic knowledge to get you started on your journey to becoming a sound engineer expert for your band! Better yet, getting your STUDENTS to be the expert!

So you might be wondering…Why do I NEED to have PA equipment for my modern band? Technically, you don't….You could continue to have everyone run independent amps and have your vocals run through a loudspeaker, everyone turning up louder and louder because they can't hear themselves over the drums then it gets to that wicked awesome guitar solo that little Jonnie worked so hard on... but it gets buried by the bass player chugging on a low E string. Have you been there? I sure have! It gets old.

Now, imagine this….At the beginning of your modern band rehearsal every single one of your modern band students has a specific job when setting up for class. Say for example you have 10 kids in your band. Some students are the power people supplying the electricity to every device that needs it. You have cable dudes (or dudets), some who are running XLR cables and the others supplying 1/4" cables. You have the muscle kids. These kids set up the speakers, stands, amps, and floor monitors. Then you have the sound engineers. I typically save the smarter kids for this job…so…no drummers. These students are the ones that make sure everything is plugged into the board, instruments, and amps correctly. They plug them in the same way every single rehearsal. You turn on your digital mixer, recall the modern band scene, and BAM! Instant control over almost every aspect of sound your band will produce. My favorite button to push?? MUTE. My second favorite button to push? TALKBACK. Total time to set this up each day in class? About 10 minutes. My sanity? Priceless. That is why you NEED a functional PA system. It makes the education process SO much more fulfilling for our students providing a whole other dimension to your modern band and how students can be involved. Finally, it gives the opportunity to properly balance our bands to what our audience wants to hear. There is nothing more annoying than being "that guy" who is constantly running up and adjusting amp volumes for their students on stage WHILE they are performing! Now, if you somehow have the ability to even leave part or all of your PA system up throughout the day you are in hog heaven!

This session will feature information related to purchasing, storing, and using sound equipment for modern bands. Starting with a very basic sound setup, this session will have resources available for how to setup, use, and store basic sound equipment. From there, we move on to what components I have found most effective in building a solid sound setup for our high school's modern band. I will show what the progression of purchasing equipment looked like for our program. Items talked about heavily will be effective options for mixer boards, cabling and management, speakers, amplifiers, mics, running instruments directly into a PA system, in-ear versus floor monitoring, and storage solutions for equipment. Finally, we will offer some tips for how to train student sound engineers and band members in how to properly use, care for, and operate equipment. Resources will be given for how to learn more about specific equipment functions such as utilizing gates, compressors, and effects on sound boards and some quick tips on how to EQ different instruments and sounds. This poster session is meant to be

understood easily and quick to apply within any modern band program whether it be a young program or a well-developed show level band.

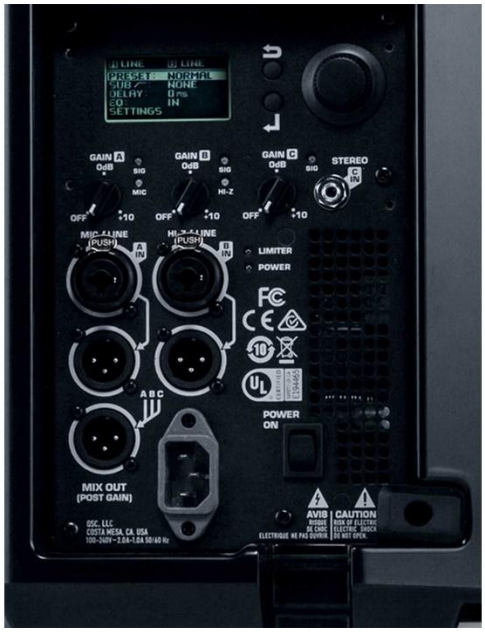
The Speakers

So, right away you will need to make a couple decisions in developing your PA system. The first most important question is do I want an **Powered Active Speaker Setup or a Non-Powered Passive Speaker Setup**? There are pros and cons to each setup. First, let's identify what each setup means. A passive, non-powered, speaker setup means that there needs to be an amplifier somewhere within the PA system to power the signal being sent to the speaker causing it to produce the sound for the audience. Passive speakers can be powered one of two ways. Either by purchasing a powered mixer board or by purchasing an amplifier. An active, powered, speaker setup means that the amplifier needed to boost the signal coming into the speaker is built into the speaker and is an "all in one" unit.

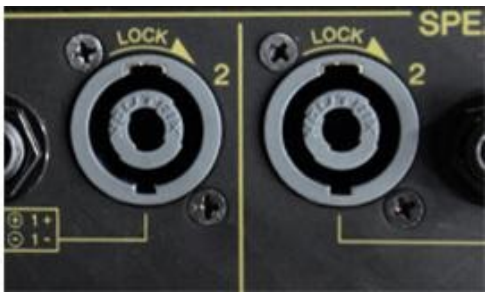
What are the pros and cons of each setup? Passive speaker setups tend to be cheaper, however, they require you to have more cables, some of which are specialized cables, and potentially more pieces of equipment to run them. The cables used to send the powered signal to passive speakers are either ¼" or Speakon cables. The problem with that? If I need to run my speakers 50 feet away from my mixer board and I only have a 25 foot ¼" cable or Speakon cable, I'm most likely up a creek without a paddle. Almost all active speakers use a combination XLR inputs meaning I can just hook XLR to XLR cable until I get to the necessary length required. You can't do that with ¼" or Speakon cables. Powered active speakers tend to be more expensive, but other than running power to them they are ready to go once you run something into the input jack. Another big pro of the powered active speaker setup is say your principal decides to do an impromptu assembly and all he needs is a mic and something to run some music through. You can plug in a microphone and a computer for music simultaneously directly into the back of a powered speaker, daisy chain to another powered speaker for more juice if needed, and be up and running within 5 minutes. My preference? Powered active speakers. I find them to be much more versatile and much simpler to set up. The YouTube link below goes into heavy detail on active versus passive speakers with valid points on each side.

Want to know more???.....https://youtu.be/nbBULZpkeL8

Active Speaker Back



Passive Speaker Back and Cable

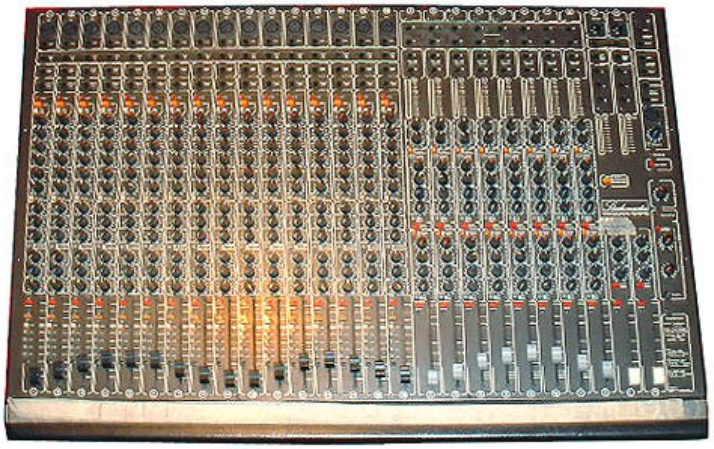


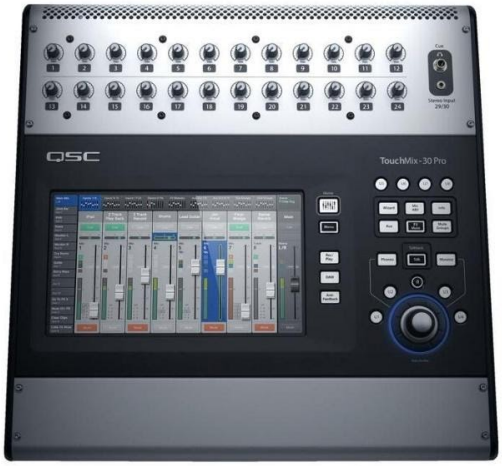
My two cents: Go with 4 QSC K12's and a QSC KSUB if you can afford them. They are worth every penny. They sound amazing and their versatility is unmatched. For those on a tight budget other popular brands/models are Behringer B1112D's and Mackie Thump12A's. While a subwoofer is technically not necessary, it is a nice addition once your main speakers are purchased. I use my K12's for my two main speakers and often use the other two as floor monitors.

The Mixer

Okay, so you've decided on active speakers. Good for you! If you decided passive speakers were what you wanted just understand that you will either have to purchase a powered mixer (far less good options) or a separate amplifier to power your passive speakers so you can use one of the wicked awesome mixers (or soundboards as they are also called) that we are going to talk about!

Important decision number two in building your PA System……Do I want an **Analog or Digital Mixer**? The answer to this question is much more difficult to answer in my opinion. Each setup truly has some strong pros and cons. Let's identify what is what. An analog mixer means that every function the board has to offer is done so using a knob or a fader (the slider thingys). What you see is what you get, and it is all laid out right in front of you. You can see every function of the board at once. The only digital component to an analog board nowadays are the FX functions but 95% of the board is controlled using a knob or fader. The digital mixer can look much less menacing upon first glance with most of its controls happening through different menus and screens or my personal favorite…an iPad. Below are two examples of an analog board and a digital board. Believe it or not…the one on the right has almost twice as many inputs and outputs as the one on left.



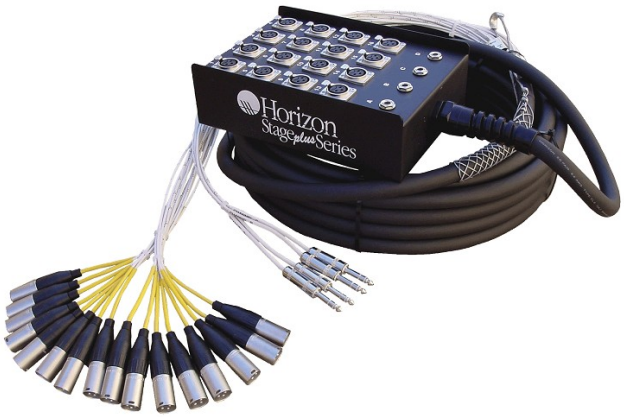


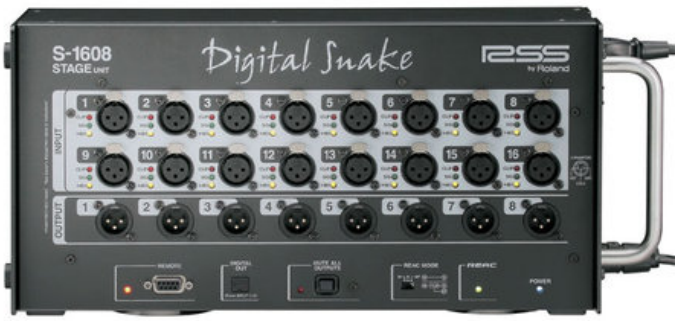
What are the pros and cons of analog versus digital? The biggest pro for analog is education. I have found that it is FAR easier to show my students how a board functions using an analog board than digital. Why? Because it is laid out in front of them like a road map. They can visually see how everything is patched together and where the signals are being sent. In terms of cost analog boards tend to also be cheaper. A con I have about analog boards is their size. I like to travel for shows as light as possible, big analog boards cramp my style. Now why digital? Because I can not only walk around the room with an iPad controlling the functions of the board and not be glued to a desk, but I can also be VERY specific with what I am controlling in terms of frequencies and equalization (more on this later). To give you an idea…Say I was getting horrible feedback whenever my vocalist was singing a particular note. On an analog board I would be sweeping through knobs trying to find the frequency that is near the feedback note, so I could cut it back. Sometimes I find it, but sometimes I cut too many frequencies due to it not being able to

narrow down as much as I would like. With my digital board it will SHOW me the frequency that is feeding back and allow me to cut JUST the single hertz of frequency if I wanted to. Being digital frees me up as a teacher, no longer having to sit behind a soundboard constantly babysitting channels and allows me to be very specific with my functions on the board. The other perk of digital? Do you have more than one kid that wants to learn how to be the sound engineer? Most digital boards allow you to use multiple iPads to control the functions of the board at the same time! Instead of cramming them behind a single board I could put one kid in charge of just vocals and maybe another in charge of just the guitarists. While this will be written about more later, digital boards allow you to do monitor mixes in much greater detail especially if you'd like each performer to be responsible for his or her monitor mix to relieve the pressure on the sound engineer to send to the performers what they want to hear. If you are looking to utilize in-ear monitoring some boards allow band members to turn their phones into personal audio mixers for what they hear in their in-ears. Pretty cool, right!?

The compromise. There are two ways I battle with my analog versus digital wants and needs. The first is I put my students on an analog board for the first few months of their training before transitioning over to digital. This gets them the basics they need to truly understand how to mix. You can pick this soundboard up for CHEAP. It's a Behringer analog board with 16 channels and I think I picked it up for like $50.00 used. The second way is I also have what I call a **Digital Hybrid Mixer**. It has lots of digital functions but isn't run 100% without faders or from solely an iPad. The Allen and Heath QU16 is a good example of this.

Another item to keep in mind with analog versus digital is placement location of the board. If you have an analog board your sound guy will probably be off to the side of the stage using a pair of headphones to hear or in the audience to hear the live sound production. It can be cumbersome at times to figure out where to place an analog board. Often it also involves running a "snake" to the stage so everyone can plug in, only having to run a single large cable to the stage versus running 32 XLR cables to the board through a crowd…..Ask me how I know. Pictured below on the left is what an analog snake looks like. You will face the same challenge using a hybrid mixer but it looks a little different. Instead of running an analog snake to the stage you run a digital snake. This digital snake is run using CAT-5 or CAT-6 cabling (the same stuff that you hook into your wireless router for the internet). Pictured below on the right is a digital snake.





Final thoughts….The other item you need to understand when selecting a mixer board are the number of inputs and outputs you need for your band. Not sure how many? Always do more than you think you'll need. An 8 channel input is typically the smallest and a 32 channel input is usually the largest needed. The best way to decide? If there is a chance you are ever going to mic an acoustic drum set get a 32 channel board. At minimum, I would recommend a 16 channel input board. **REMEMBER** not only are mixer boards responsible for taking the signals in from the guitars, keyboards, bass, drums, and vocals but they are also responsible for sending that signal

out to different speaker setups! Most analog boards have a very limited number of outs or AUXS as they are called. They will usually have a left and right Main out and 1 or 2 Monitor outs (if it's a less expensive board). The AUX outs are in addition to the main outs and monitor outs. Mains are what the audience is going to hear….Monitors and AUXs are what the band is going to hear. Monitors allow you to control what the band needs to hear more of to stay tight when playing for example, my vocalists like to really hear the kick, snare, and guitar in their monitor mix but my guitar players who are standing next to the drummer don't need that mix. They need a mix of vocals and bass. But my drummer hates listening to the vocals and only wants to hear bass and guitar. Right there I need 3 different monitor mixes. Starting to see the picture? ALSO, if you are going to run a subwoofer for the audience to really feel that bass it will also need it's very own AUX mix because to just hook it to the mains could sound extremely muddy depending upon how many frequencies it is set up to hit on. I would be comfortable with no less than 4 monitor/AUX outs.

Want to know more about analog versus digital boards?..... https://youtu.be/7JP8K8IQ0ws

My two cents: Get a Behringer analog board to start with until YOU understand the functions of a mixer board and will appreciate and be able to fully utilize the flexibility of the digital realm. Every board that is of decent quality has a TON of YouTube videos dedicated to teaching you the functions of the mixer board you select. Use them and use them with your kids. Once you are ready to make the leap to the digital realm some good digital boards would be the Behringer X32, Allen & Heath QU Series, or PreSonus StudioLive. If you want a board that can be all controlled from an iPad I highly recommend the QSC Touchmix 30. Keep in mind with my Touchmix I don't have to worry about board placement and rarely do I need to run a snake as I can place it right in the middle of the band!

The Monitors

Ever wonder why so many bands fight feedback? Typically it's due to a monitor being placed incorrectly or a performer not being aware that they are too close to a monitor or speaker. Monitors can be some of the most frustrating things for sound engineers and bands to get right. What are monitors? Monitors are how bands are able to hear themselves while performing. Typically, you will see these as speakers or floor wedges that are pointed towards the band versus the crowd. Floor monitors are also why bands will stand in certain formations. Why? Because each band member typically has their own monitor mix they want coming out of the floor. Monitor stations, as I like to call them. Typically you have one for vocalists, guitars, keyboards, and drums. Each station can receive a different mix. Now, depending upon which soundboard you choose will determine the number of different monitor (or AUX) mixes you can send. At minimum most boards are capable of sending at least one monitor mix.

There are three different types of monitoring you can do with a band. The first school of thought is no monitors at all! Listen intently to one another to hear the items that need to be heard. USE YOUR EARS! Depending upon your band and venue size this is a very viable option, for example a five-piece band playing a coffee shop. Sometimes less is more and as discussed above sometimes monitors can be more of a pain than they are worth. The second way to achieve monitoring is through floor wedges. What I like about the QSC speakers is I can use them for either mains or floor wedges interchangeably. Look for speakers that have a 35-45 degree angle on the sides of the box (most speakers do) and they can be used as floor monitors. Nowadays, almost all speakers that are manufactured can be used for mains or floor monitors. Keep in mind, however, that floor monitors have a higher chance of being abused just due to their location. Therefore, I tend to run the cheaper gear on the floor, however, I still highly recommend using active speakers. The way to achieve monitoring is using in-ear monitors. These are the headphones you might see church bands or professional bands use. There are two main reasons for in-ear monitors. No more feedback issues due to floor monitors and no more being glued to a certain spot on stage so you can hear what's happening around you. I used to think in-ear monitors were out of the question for my modern band BUT we have found a fairly inexpensive way that has worked for us!

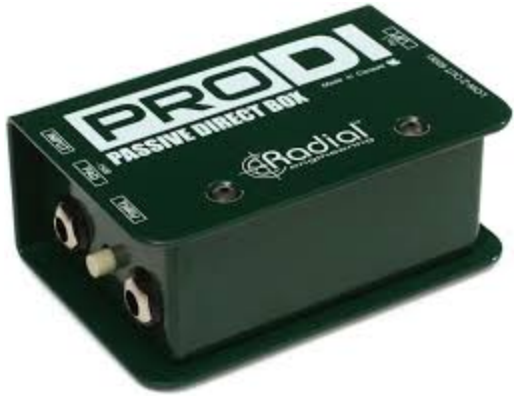
Galaxy Audio has a very inexpensive in-ear monitor setup for $200.00 called the AS-950. They also sell an in-ear monitor kit for $549.99. Keep in mind these transmitters allow you to send only one monitor mix but it can be received by multiple in-ear packs. You can get a maximum of three different transmitters each on their own frequency band so you can run three different monitor mixes. It is extremely important to make sure if you buy multiple transmitters that they are all on different frequency bands otherwise you will have "talk" between the transmitters making the mix unclear. This particular brand only offers three different frequency bands, but other more expensive brands offer far more. This has been the most inexpensive way our modern band has found to have in-ears. The next best option comes from Behringer. Instead of running floor wedges, the Berhringer Powerplay offers a very inexpensive way for each student to receive their own monitor in-ear mix. Granted, each pack is attached to the board via a XLR cable, but it does provide some mobility while being on stage. In my personal setup each student controls their own powerplay mix using their cell phone! Another option to have in-ear monitors is by using an Aviom (or similar brand) personal mixer. These are connected using CAT-5 or CAT-6 wiring out of the back of a digital mixer. The perk of using such a setup is potentially each performer would have full control over what they are hearing versus it falling on the sound engineer to get it right. The downside is unless you have wireless in-ear receivers you are once again glued to a spot due to the length of your ear-buds.

My two cents: Use one of the Galaxy Audio AS-950 setups for your vocalists and have everyone else use the Behringer Powerplay. Your vocalists need to be freed up to move around the stage to give your band presence! Remember you only need a single transmitter and can run as many receivers as you want just understand that it will be the same monitor mix for everyone! If I were to purchase a second setup it would probably go to my guitarists. I would also recommend talking to a sound engineer experts in your area prior to purchasing any in-ear or wireless equipment in general. Cell phone towers and phones in general are starting to effect some frequencies depending upon the carrier and area.

Guitar, Keyboard, and Bass Amps

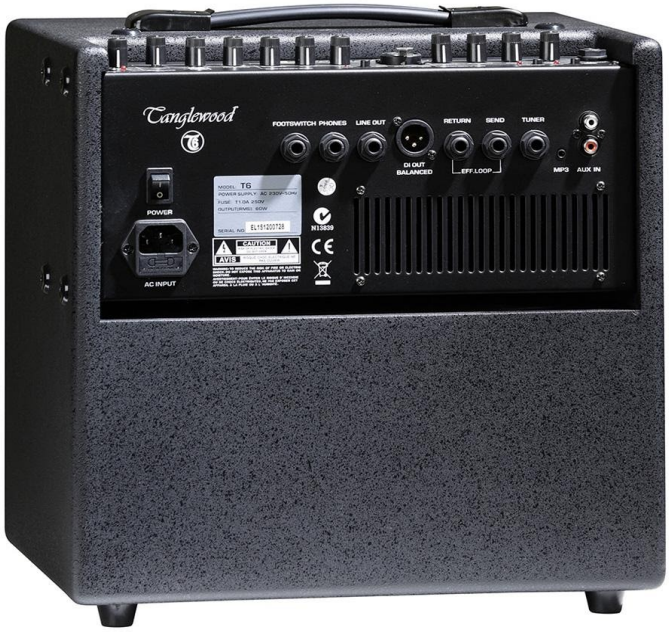
Your band is getting bigger and more advanced so they need larger guitar, keyboard, and bass amps to play over the massive crowds, right? THINK AGAIN, USE DIRECT IN! That's right…giant guitar stacks are a thing of the past. While they look cool, you don't need them! I would recommend investing in 50 Watt amps, 100 Watts maximum. You might be wondering…how is my shredding lead guitar player going heard playing for 10,000 fans using only a 50 Watt amp? Use the 50 Watt amp as a self-monitor and run a line out from the amp to the board, of course! **Direct Boxes** have become one of my favorite tools. You can see one pictured below. They allow you to run an instrument such as a guitar, bass, or keyboard directly into the mixer board without needing an amp. Essentially they take an unbalanced 1/4" cable and make it a balanced XLR cable making it a usable signal for the mixer.

Want to know more?..... https://youtu.be/lCXHsLf2urI



Have you ever wondered why every time you run your "line out" from the back of your 50 Watt guitar amp to the mixer board the speaker on the amp shuts off but the sound comes through the main PA System just fine? ME

TOO! If someone would tell me what idiot decided that's what needed to happen when you plug into the line out I'd love to meet them and give them my two cents….Regardless here is what YOU need to do. Take your guitar amp to your local music electronics wiz….if you aren't sure who this is contact your nearest music store and ask who fixes amps in the area….have that person either put a Direct Out (XLR no need for a direct box) on the back of the amp or a separate Line Out (1/4" and still need to use a direct box) that doesn't cut power to the amp speaker. IT CAN BE DONE! How do I know? I did it on ALL of my amps. The downside? It will void your manufacturer warranty….but who really uses those anyways. The pro far outweighs the con in this case. Keep in mind if you are purchasing amps for your band….Some higher end amps will already have a nice Direct Out (Also labeled D.I. OUT) already built in. They are almost always XLR outs that will allow you to run directly to your mixer board. An example of what this might look like on the back of the amp is below.



Instead of all my amps facing forward towards the audience, I have my players either turn them in towards themselves for a personal monitor OR I have some turn them to go across the band not to the audience, so the band can hear each other (potentially without the need of floor monitors) and I let my PA and Sound Engineer take care of what the audience will hear.

One final note on amps…..ANGLE THEM UP! Figure out a way to angle your amps for self-monitoring at your head not your knees! Prop them up on something or have a wicked cool parent build you some amp stands. It makes a HUGE difference. It will prevent people from constantly playing the "turn it up" game. Your knees don't interpret sound very well…..

Microphones

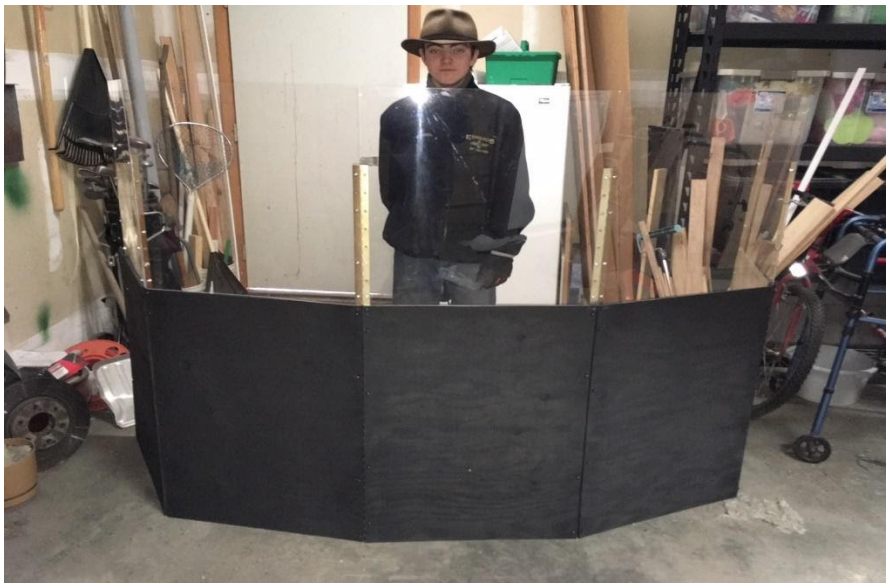
To be wireless or not to be wireless? That is the question! This is an area that people could go around and round on this topic for days. My comment on microphones is this….you get what you pay for. My recommendation is if you are going to go wireless, spend more money to reduce the chances of interference or chatter. There is something very reassuring about the indestructible nature of a corded Shure SM58. But there is something very freeing about being able to march around a stage without worrying about whether or not a student is about to rip an XLR cable out of the board.

I'm not going to go into detail about the differences between Dynamic and Condenser microphones, however, I will link a video below to talk about what those differences are. Primarily you will want to use a Dynamic Cardioid (Unidirectional) microphone for your vocalists in a live performance setting. There are two main live microphones I use for my vocalists: an SM58 style and a SM86 style microphone. I like the SM58 for its smaller area that it picks up sound. Unless you are right in the center of the mic and right on it, it won't pick things up very well. It does a nice job of not picking up bleed from other instruments. The SM86 is nice for vocalists who either won't put the mic in the same spot every time or who move around a lot. The SM86 does run the chance of picking up more bleed from nearby instruments or monitors causing feedback, but gives the vocalist a little more flexibility in terms of placement. My recommendation is until students truly understand microphone placement they should be using a mic stand!

SM58

SM86

One question I get a lot from people is putting mics on the drumset. Do I or don't I mic the drumset? If I could do it all over again I would HIGHLY recommend purchasing a nice electric drumset (Roland or similar). Balancing the drums is such a headache and the only true way to balance an acoustic drumset (other than by truly listening and playing balanced) is by completely secluding the sound using a drum shield. A decent drum mic kit is not expensive (anywhere from $200-$500) but the only way I have found them to be effective is by purchasing or building a drum shield. The good news is this can easily be done if someone has a free weekend and access to power tools. FYI this is a great service project for a kid! We used ½" plywood and 1/8" plexi glass to construct our drum shield. It cost a grand total of $100.00 hardware included. This simple shield made a WORLD of difference in our ability to balance the drums and bring the overall sound level of the band down.



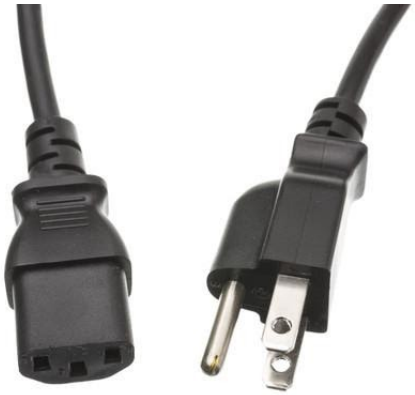
Want to know more on microphones?..... https://youtu.be/Y01N_L1VA4I

Want an idea on how to make a drum shield?..... https://youtu.be/Qbht9lxGqxo

My two cents: Invest in good mics. We use corded mics for rehearsals and use wireless equivalents as we get close to performances and during performance to save on batteries. I would also recommend investing in good mic stands that don't fall apart or fall over. I've come to really like boom mic stands for the versatility in anything I want to use them for besides just vocals. Finally, as I have stated before I like to run on the least amount and lightest equipment possible. Having to lug a full acoustic drum set, drum shield, and mics around is a pain. If I could do it over again, I would have spent the money on a very nice electric drum set to save space and hassle. Drums are the only instrument group that I don't have a full "mute" button for, going electric would allow me to finally have silence whenever I want!

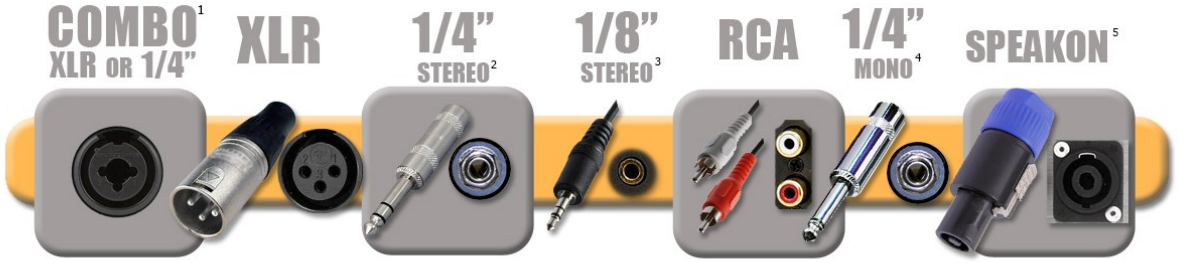
The Cables

If everything ran off the same cable life would be so simple when it came to sound! Unfortunately, this simply is not the case. Cables are the backbone to making everything work and come together with ease. Let's quickly talk about power cables first. Did you know that once you reach the pro level in audio equipment 90% of your gear including amps, speakers, and mixers run using the same power cable pictured below? If you didn't already know this is a simple computer/monitor power cable. Do you know who has a ton of those and they can't get rid of them fast enough? THE TECHNOLOGY DEPARTMENT AT YOUR SCHOOL! Just this past school year, I went on the hunt for more power cables, I don't know about you but mine have a tendency to disappear, and boy was my technology person happy to give me a giant box that went to old computers that she was about to throw away! SCORE! Power cables for days. Now if only audio cables were that easy…



Audio cables come in many different forms. You have 1/8”, 1/4”, RCA, XLR, and Speakon are the primary ones that I use in my modern band. What I have found is this….the goal is to get everything to run through XLR cables! XLR cables are your friend. You can connect as many together as you need for length and they are what will run in and out of your mixer board. Use them and get as many adapters as you can to get from whatever you running to XLR. You might be wondering….why would my goal be to get everything to XLR? Two words….Unbalanced and Balanced. XLR is the most friendly balanced cable to use and has the ability to be daisy chained together. XLR is also what runs primarily in and out of your mixer board. 1/8”, 1/4”, and RCA are all unbalanced cables meaning they are more likely to be noisy near items such as power sources. Watch the video below to learn more about balanced and unbalanced cables.

Speakon and 1/4” power cables serve an alternative purpose. Whenever you purchase an unpowered speaker the signal needs to be powered somehow in order for the speaker to actually project. These two cables supply not only signal but power to the backs of non-powered speakers. They cannot be converted to XLR cables due to their inability to carry signal AND power.



1. This input jack accepts XLR or 1/4”. Really.
2. AKA: TRS, Tip-Ring-Sleeve or Balanced 1/4”
3. AKA: 3.5mm Stereo or Mini Stereo
4. AKA: TS, Tip-Sleeve, or Unbalanced 1/4”
5. AKA: NL4

Want to know more?..... https://youtu.be/g7Pd6NdgX80

Cable organization can be a bear, but it doesn’t have to be! Color code your cables for your students! For example, all of my 15 foot XLR cables are red Velcro banded, but my 25 foot XLR cables are yellow Velcro banded. I have become a diehard fan of the little Velcro straps pictured below. I purchased mine at Harbor Freight for ridiculously cheap. Use them to color code and wrap your cables to keep them organized for you and your students. Yes…. I’m someone who spent an entire rehearsal showing kids how to properly wrap and store cables. But it was worth it and it will save you a ton of time and money! Use totes or hooks to then store your cables.

Want to know more?..... https://youtu.be/KZ4ZKkJ_HxE