

How to Use a Digital Audio Workstation

First course, First grading period, Week 6

Students need to learn the basic operation of the digital audio workstation. It is a knowledge and skill they will refine throughout the four courses in Radio Broadcasting.



Enduring Understanding

The digital audio workstation is a mainstay of the radio world. Without it, the radio professional cannot produce radio work quickly and efficiently in our digitally driven environment.



Essential Questions

What is the purpose of a digital audio workstation and how does one use it? What terminology does one need to communicate with clarity?



Objectives and Outcome

Students will acquire a basic vocabulary in order to discuss the parts of digital audio workstations using a common language. Students will learn the barebones basics of the digital audio workstation.



Suggested Time

Five days



Resources and Materials

The classroom teacher should have chosen which digital audio workstation editing system to use prior to the beginning of the semester and should be familiar with it. This lesson will be based on the basic principles of all workstations, but it will be necessary for the teacher to demonstrate how the particular classroom's workstation works and the teacher needs to be very familiar with that particular system.

Obtain suggestions for which system to choose and specific operations instructions from the manufacturer. It is suggested that a handout that contains the specific visuals of that system be provided to students. For the purposes of this lesson plan, and not by way of endorsement, we have selected Protocols manufactured by Digidesign (<http://www.digidesign.com/>). Protocols is a very popular industry standard and can do both complex and simple audio functions well.

Some of the best sources for operating information on Protocols can be found on the Web. They include:

- <http://www.radiocollege.org/>
- <http://www.jrn.columbia.edu/StudentWork/radio/help/index.asp>
- http://www.transom.org/tools/editing_mixing/200111.voiceediting.jtown.html

Teachers may wish to refer to the basic manual first. See the first few chapters which explain the basics with pictures.

“Digital audio workstation,” Radio Production, pages 27-30

“Radio Reporting Equipment,” Announcing, pages 172-177



Procedure

1. Teachers should start with the basics of
 - What is a digital workstation?
 - What does a digital workstation do?
 - What are its advantages?
 - How does one open the operating system?
2. It would be a good idea to use visuals immediately. To prepare, teachers should have already loaded copies of the free Protools software (or other preferred operating digital audio system) on each classroom computer. Load an audio sample also. (A detailed discussion of the basics of mono and stereo is not necessary here, but mono and stereo should be mentioned.)

It is also suggested that there be several files with progressive examples that demonstrate voice tracks only; voice and audio clips; voice and music; and voice, audio clips and music. By playing each in class and showing that process of adding more audio tracks — projected on a screen that all can see — it will be easier to discuss how and why each audio example looks different on the displayed screen. Students can immediately see how the system displays and combines sounds.

3. Next, using the most basic example of voice only, teachers should go step by step through the different options on the screen. Go through the selection of tools in the session and what they do. It is essential to teach students to create their own files and to learn to import pre-selected audio.
4. After about 30 minutes of basic discussion with visuals, students should break into small groups and at the digital workstations create and name their own individual files. Both import a CD and dub in pre-selected audio from the minidisc. During this activity, teachers want to get across that different audio sources can be put into the session. This activity should take 10 to 15 minutes per person.

While students are waiting for their turns, they can be studying diagrams of the workstation with parts identified and learning any vocabulary you might have compiled for this lesson.

5. After their files are created in a folder labeled “First Session,” each group of students should be given “Introduction to the Digital Audio Workstation,” an in-class assignment. They should rotate watching each other complete each item, unless the classroom has enough computers for each student to work individually.
6. At the end of class, if not already provided, give each student a copy of “Digital Audio Workstation Vocabulary” that you have developed. Within a week, there should be a pop quiz. If students pay attention and work actively for the several days that audio workstations are taught, studying these 10 to 15 terms after class will not be a chore.

As all digital audio programs use different terminology and do slightly different things, the teacher MUST compile a list to suit the individual program the class is using.

7. For a week, students should be given progressively harder tasks. Cover editing in detail and have them isolate cuts of audio (“top and tail”) and learn to make clean internal edits keeping a regular rhythm of breaths.

There is no such thing as too much practice, but usually today’s students grasp this technology very quickly. Don’t be fooled. Concentrate on the editing subtleties. Students who begin to master the basics can go on to adjusting the audio and volume levels. Anyone who gets it all right away should be a designated mixer of future more advanced projects as needed by the class.

8. A word of caution: Students MUST get in the habit of making a back-up of their audio material on a personal data disc. When they have more projects, only the most recent files should be on the mainframe of the classroom computer. All of their work should be backed up on a CD.

Some teachers encourage students to have two CDs for their work; one that never leaves the classroom (a data disc of session files), one that they may use at home (an audio CD of selected material). They should understand why they are making different kinds of files and the advantages of each. The point here is whatever your requirements, back-up all work.

Teachers should consider getting expert advice on how to back-up all data on their particular workstation to a separate tower. If your computer should crash, you do not want to lose all files. Too much audio stored in the system can crash it.

9. Students should create an audio portfolio with work representing all stages of their development and projects in Radio Broadcasting I-IV. At the minimum, students’ portfolios should include their first work and term projects.



Homework

Give students a copy of “Digital Audio Workstation Vocabulary.” Review the vocabulary list of terms and insist that students always use them when talking about the workstation. Let students know that you expect these terms to become part of their personal vocabulary. They are for daily communication, not just for a vocabulary quiz grade.

Have students check out and read the Web sites listed above, the manual, a handout from the manual, and learn the vocabulary for a quiz.



Assessment

Do not grade the student’s ability to operate the system immediately. Experience and learning will ONLY come with hands-on practice.

Do grade and record the vocabulary quiz. All students must master the vocabulary before they go on to harder lessons in the use of protocols. It is essential that all students know and use the common language required. For example, all students call the grabber “the grabber,” not “that hand.”

Over the next several days as this lesson progresses there will be a chance to evaluate each student's understanding of the digital audio workstation more fully. On the first day and the second day, they are becoming familiar with the equipment by using the software and mastering the skills listed on "Getting to Know the Digital Audio Workstation."



Academic Content Standards

National

Understand the principles, processes, and products associated with arts and communication media (McREL, Standard 1, Arts & Communication Career)

National Benchmark

Know skills used in electronic communications (e.g., producing audio recordings and broadcasts, producing video recordings and motion pictures). (McREL, Arts & Communication Career, Grades 9-12)



Industry Standards and Expectations

Examine equipment and its function. (Performance Element, Pathway KS Statement: Demonstrate knowledge and understanding of technical support related to broadcasting, States' Career Clusters, National Association of State Directors of Career Technical Education Consortium)

Identify the basic functions and resources for editing. (Performance Element, Pathway KS Statement: Exhibit knowledge of editing audio and video productions, States' Career Clusters, National Association of State Directors of Career Technical Education Consortium)

The SkillsUSA Championships Technical Committee selected the following competencies as essential and to be demonstrated through their radio competition project:

- Demonstrate knowledge of audio production technology, safety procedures and trade terminology,
- Plan radio/audio production,
- Perform audio recordings and editing operations,
- Perform audio mixing, and
- Complete script.

The National Certification Committee of the Society of Broadcast Engineers suggests knowledge of the following in preparation for the engineering SBE certification examinations: NAB Engineering Handbook; FCC Rules, Code of Federal Regulations, Title 47 (Telecommunications), Parts 0-19, 70-79; and equipment manufacturers' instruction manuals. (www.sbe.org/Ref_Engineer.php)

Getting to Know the Digital Audio Workstation

Name _____ Date / /

The Digital Audio Workstation is a mainstay of the radio world. Without it, the radio professional cannot produce radio work quickly and efficiently in our digitally driven environment.

After you have finished each assignment, save it on your CD.
Check off each accomplishment in the boxes below.

- Create your own file folders
- Create a session
- Create mono track
- Input audio from the minidisc. Watch your levels closely.
- Create a set of stereo tracks and sum them
- Input a CD
- Go down the row of tools, practice each one
- Save the session
- Bounce the session audio
- Burn the audio to a CD

List below the tools that you practiced. Briefly explain the function of each one — what does it do? You may use the manual to help you to understand these tools. Do not hesitate to ask your teacher questions when you are practicing the tools.

The Nature of Sound

First course, First grading period, Week 6

Sound waves are something that we physically cannot see with our own eyes alone. They have to be heard. Sound is vibrations of air pressure, and it is this vibration that we are actually hearing. If you think of it as holding a piece of string with both hands, and having a friend pull it down and let it go, this is much like the same principle. You can see the string vibrating. The stronger the pull, the more the vibrations.

In the current world of audio and broadcasting, we have digital computer systems that let us see the waveform of the sounds we have recorded. Instead of cutting tape, as in the old analogue days, we can now edit right in the computer, using not only our ears, but our eyes as well. In this lesson, we will break down the basic components of what is in sound and how it applies to our understanding of broadcasting.

Brian Jarboe, NPR engineer, provided this lesson. Sohn Butts, McKinley Technology H.S. (Washington, D.C.), contributed to this lesson's development.



Enduring Understanding

In this lesson, students will learn that sound is not just something that we hear, but also something we can “see.” This understanding of the different elements of sound will help students as they learn more about broadcasting, radio and production.



Essential Questions

What are the different components of sound? How are these elements combined to produce a sound we hear and a waveform that we can see on a computer editing system? How will this knowledge help students in a career in broadcasting?



Objectives and Outcome

- Students will be introduced to basic properties of sound.
- Students will be able to identify and give a basic explanation of the different elements of sound.
- Students will be able to look at a waveform and identify these elements.
- Students will be able to do rudimentary editing of these waveforms on an editing system



Suggested Time

Two to three days



Resources and Materials

Piece of string for each student, to visually witness the vibration
Chart with a basic waveform, highlighting each element

Fear of Physics: Physics. Explained. Finally.

(<http://fearofphysics.com/Sound/dist.html>)

The Physics of Sound (<http://library.thinkquest.org/19537/Physics3.html>)

AM, FM Waves and Sound (<http://www.cybercollege.com/frtv/frtv019.htm>)

Waves Types

(<http://www.acoustics.salford.ac.uk/feschools/waves/wavetypes.htm#introd>)



Procedure

1. The day before the first class session on sound, ask students to write a description of sound found in their world. If sufficient field kits will allow for it, students could be asked to record the sound as well as describe it in words. At the beginning of class have students read their descriptions, then have other students guess what is being described. Emphasize the importance of words that convey the five senses, similes and metaphors, loudness and pitch.

Example: The approaching sound is continuous, mournful, and annoying. All too quickly it builds in volume. It brings stressful thoughts and almost automatic concern. It begins on a low frequency and builds to a higher one with continuous changes in pitch. [It is a siren of an ambulance.]

Example: There is a metallic creak before the primary sound begins loudly as it hits a hard object. Gradually, while the original sound is still there, another muffled sound is added. This is not a sound you can allow to go on too long. Although this sound results in pleasure and reminds one of a cascading waterfall, without paying attention to this sound you could become stressed out. Something might happen. [It is a tub filling with water.]

If recording the sound was assigned, after students guess what the sound being described is, the tape recording could be played. How close did each student come to describing the sound and how many students were able to identify the sound from the verbal description and/or the tape? (As an alternative, instructors could play sounds that they recorded and ask students to describe it and guess what it is.)

Use this activity to discuss the strengths and weaknesses of verbal description versus recorded sound. When does each have its place in radio broadcasts?

2. Discuss just how important sound is in broadcasting. Radio is our physical eye plus the mind's eye. Since radio is an aural medium, sound is crucial in conveying the reporter's vision to the listener. The instructor should also note that the description of objects and scenes that do not make sound and cannot be seen on the radio are just as important.

Items such as a mailbox (empty), birdhouse (broken) or a piece of cheese (moldy and yellowish blue) need adjectives and descriptors from the reporter to get the idea across – to set the details of a scene. Have each student make a list of 10 items in the classroom that need verbal detail to communicate them to a listener within the classroom setting.

Have students select one of these items to describe and then bring it to life through verbal details. Use color, size, shape, analogy and very specific descriptive language to tell listeners what is seen. Share them as a class.

Try describing the view from the classroom window in detail.

3. After the introductory activities, teachers should proceed with the basics of sound. Students should be able to answer the following questions by the end of the lesson:

- What is the definition of sound? Sound is a form of energy, just like electricity and light. Sound is made when air molecules vibrate and move in a pattern called waves or sound waves. Chapters in your textbook(s) may assist in this portion of the lesson. At the end of this day's lesson, give students "Sound Vocabulary."
- What is a sound wave?
- What are the attributes of a sound wave?
- How does one manipulate a sound wave?

4. Use the piece of string (or a rubber band) to give a visual representation of how the vibrating string/rubber band changes air pressure and creates sound. Have one student hold the string and another pull it. Make special note of how it moves back and forth rapidly. This is a very basic example of what a sound wave looks like in the real world.

5. Share with students a chart that displays a basic sound wave.

Introduce students to some of the basic vocabulary. The big elements of a sound wave are amplitude, frequency and wavelength. Review "Sound Vocabulary," terms with which students should become familiar.

- Amplitude – Measure of the amount of energy in a sound wave
- Frequency – Number of cycles per second
- Wavelength – Distance from one peak of a wave form to the next

Students should be able to identify and explain amplitude, frequency and wavelength using the chart.

6. Explain that at its core sound is measured in cycles per second, also known as "Hertz" (Hz). So a sound with a frequency of 440Hz would have 440 cycles per second. People with exceptional hearing can hear sounds from 20-20,000 Hz. Most naturally occurring sounds are in the 50-15,000 range.

7. The instructor should emphasize how sound is crucial in a radio story. Then move on to explain that with current technology, we now have the ability to visualize and manipulate those sounds on a computer. Refer students to the waveforms on the monitor of the digital audio workstation.

8. After discussion, have students see the waveforms on a workstation. Record different sounds and watch the resulting specific waveforms as they enter the file in the workstation. Take special notice of how the waves from different sources look different from each other:

- How does music look different from street ambience?
- How does a voice look different from a snare drum?
- How does a student's bass voice look different from another student's high-pitched voice?

- How does dropping a book on the floor create a specific shape you can see as distinctive?
- What does a popped “p” into the mic look like and why is it hard to cut around?
- What do breaths look like? Can you distinguish whole phrases and sentences by looking for the breaths between words?



Homework

Give students handouts of a waveform basic diagram. Take the time to understand the different elements of the waveform.

Each student should write a description of sound found in his or her world.

Students should be asked to record different sounds in their lives. Be sure to include some loud and some soft sounds. Distinguish between loud and soft sounds, and how they will translate to their story. For example, if the source is soft, will a student have to get closer to the source?

Students should be able to spend some time at a workstation, looking at the waveforms they have recorded. After this lesson and the introduction to the digital audio workstation lesson, students could be asked write about why they think some waves look different than others. They should consider how their understanding of how sound works will be helpful in getting their sounds accurately to tape?



Assessment

We don't want to burden students with too many technical aspects of sound, since we are not training engineers; however, a working knowledge of the properties of sound is extremely helpful in creating well-rounded radio journalists. Each student should be able to identify and explain the three main aspects of sound: amplitude, frequency, and wavelength. Assess students' ideas on how best to capture the sounds they want for their stories.

Test their knowledge of manipulating these sounds digitally on a workstation.



Academic Content Standards

National

Understand the principles, processes, and products associated with arts and communication media (McREL, Standard 1, Arts & Communication Career)

Understands the sources and properties of energy (Science Standard 9, McRel)

Knows that sound is produced by vibrating objects (Science, Standard 9, Grade K-2, Benchmark 4, McRel)

Knows that the pitch of a sound depends on the frequency of the vibration producing it (Science, Standard 9, Grade 3-5, Benchmark 5, McRel)

Knows that vibrations (e.g., sounds, earthquakes) move at different speeds in different materials, have different wavelengths, and set up wave-like disturbances that spread away from the source (Science, Standard 9, Grade 6-8, Benchmark 7, McRel)



Industry Standards and Expectations

Apply knowledge of equipment and skills related to audio production. (Pathway KS Statement: Audio and Video Technology and Film, States' Career Clusters, National Association of State Directors of Career Technical Education Consortium)

Sound Vocabulary

Sound is crucial in a radio story. Often actuality, ambience, music and the reporter's words are all that is need for the listener to get the whole story. It will be helpful for you to know the vocabulary to communicate what is happening among the speaker-microphone-recorder-workstation-listener. While most of you will not become engineers, a working knowledge of the properties of sound is extremely helpful in creating well-rounded radio journalists.

Amplitude	Measure of the amount of energy in a sound wave; power of a signal; sound level.
Compression	Pushing together of air molecules closest to the sound source
Cycle	Interval of time in which a repeated pattern is completed
Frequency	Number of cycles (oscillations) per second; times per second that a wave pushes on the ear drum. Frequency relates to the pitch of a sound. A frequency of 20 Hz is a very low-pitched note; a 20,000 Hz frequency is a very high-pitched note.
Hertz (Hz)	Cycles per second
Pitch	How high or low a sound seems
Rarefaction	The lowest point of a sound wave between two separate crests or peaks; the pulling apart of air molecules
Sound	A mechanical wave that moves through air, liquids and solids
Volume	The amplitude or loudness of a sound
Waveform	The visual depiction of sound as seen on the screen of the workstation; the shape of a wave.
Wavelength	Distance from one point of a waveform to the next at precisely the same phase; horizontal length of one cycle of the wave.