I. A. Instructional Goals
-The lesson will allow the students to have a better understanding of amplitude, frequency, and wavelength among different pitches of sound using technology software and musical instruments.

B. Rationale
-I am teaching this lesson not only because it is important for students to know concerning Ohio’s Grade Level Indicators, but it also integrates technology and music into a science lesson.

-II am teaching the lesson in this way because it allows for the student to visually see how wavelengths differ based on dynamics (loud and soft) and pitches (high and low).

II. Objectives
The students will be able to:
1.) Use a computer software program to compare wavelength, frequency, and amplitude among different pitches and dynamics of sound.
2.) Efficiently and effectively cooperate in groups while working on the computers.
3.) Illustrate a sound wave and label the amplitude and wavelength of different sounds.
4.) Explain how changing the rate of vibration can vary the pitch of a sound.
5.) Select and distinguish sounds that are high and low in pitch.

III. Total Time of Lesson: 45-50 minutes

IV. Resources and Materials
- 4-6 computers with sound cards (have students work in groups of 4 or 5)
- Computer Microphones for each computer
- Audacity software program (can download from internet at http://audacity.sourceforge.net/)
- MIDI Electronic Keyboard
- Drum
- String Bass
- Whistle
- Tuba
- Tuning Forks
- Lab handout, paper, pencil

V. Procedures

A. Readiness/Motivation for Lesson  
Allotted Time: 5 minutes
- The teacher will ask the students to raise their hand if they a play musical instrument or have ever played a musical instrument?
- All students should raise their hands.
- The teacher will ask the students based on what they have learned about sound waves, if they think the sound waves for different types of instruments will all look the same.
- The students should respond by saying no because some sounds are loud and some are soft, some sounds are high and some are low.
- The teacher will briefly explain to students that loudness is a measure of the amount of sound energy reaching your ears and that a sound’s pitch is a measure of how high or low it is.
- The teacher will ask the students if we can see sound with our eyes.
- The students will respond by saying no because we can only hear sound with our ears (some students may respond by saying yes, because we can see objects vibrate when they produce sound waves).
- The teacher will get the students excited about the lesson by explaining to them that in today’s activity by using computer technology we will be able to “see” sound easily and distinguish between different dynamics and pitches.
- The nature of the problem for the students to solve would be to visually see the different wavelengths, frequencies, and wavelengths among different sounds.
- Before the teacher starts the lesson, he or she would have prepared by testing out the technology and trying different sounds that the students may choose to use.
- The teacher will provide the instruments while the students provide the data based on the information they discover about the various sounds.

B. Focus of Lesson  
Allotted Time: 30-35 minutes
- The students will be divided into groups of 4-5 students based on where they sit in the classroom and each group will be assigned a computer.
- Before they start using the computers, the students in their groups will write down a list of the 5 different sounds they will like to test. The students will have to show their list to the teacher and have it approved before they are allowed to begin the lab.
- The teacher will give each student a lab worksheet (“Think Sheet”) with questions to complete during the activity that will guide the students through the lab.
- While at the computers, the students will use the Audacity software and microphones to view the wavelengths of 5 different sounds (examples: voice, electronic keyboard—which students can change instrument
sounds, string bass, whistle…) and vary the loudness and softness of these sounds.

- The students as a group will complete the questions on the lab worksheet concerning the different types of sounds they see and then draw the different sound waves in the space provided on their lab worksheets.
- The students will label each wave’s wavelength and amplitude.

- ASSESSMENT® The teacher will informally assess the students’ comprehension of the content material through observations and questions the students may have while completing the activity. The teacher will also be informally assessing how well the group is cooperating and working together to successfully complete the activity.

C. Closure to Lesson

Allotted Time: 10 minutes

- After students complete the activity at the computers, students will go back to their seats for a class discussion.
- The teacher will ask questions based on the lab and lab worksheet.
- Each lab group will present to their classmates what conclusions they discovered on sound waves based on the different sounds their group selected.
- ASSESSMENT® The teacher will assess the students informally through the class discussion. Using a rubric, the teacher will grade the lab worksheet students turn in to assess their comprehension of sound waves, pitch, and loudness.

***This particular lesson would work best with enough computers to have 4-5 students per computer or about 4-6 computers in the classroom. This way, students can work in small groups and each group is utilizing a computer at the same time.

***If the classroom is equipped with only one computer, the students can be in the same groups but rotate using the computer. Each group will be responsible for viewing 3 different types of sounds that are different from other groups. Time at the computers should be about 8-12 minutes per group. While other groups are using the computer, the students at their desks will either be completing the lab worksheets, creating a poster that displays the different sound waves they viewed and their frequencies, amplitudes, and wavelengths, or predicting and discussing what the differences will be in their sound waves if they have not began the computer work.

***If the class can be held in a computer lab with all the needed technology tools, each student can be responsible for viewing 2 different types of sounds and comparing their results with their group’s results. Students can complete the lab worksheets together; however, because each student is finding his or her own data, the results may be different.

D. Follow-Up (Enrichment)-Optional

Allotted Time: 5-7 minutes
-Teacher will demonstrate how vibration can vary the pitch of a sound by using a violin and changing the lengths of the vibrating strings with his/her finger.
-Students will predict and draw how the sound waves of the two different pitches will be different.
-Teacher will display the sound waves of the two different pitches on the computer screen.
-Students will assess their two drawing of sound waves to see if their predictions are accurate.

** Modifications for Students with Disabilities**

- If a student has motoric impairments, switches can be designed and a keyguard can be used to direct fingers to the keys and can be used in conjunction with a program that inhibits the repetitive production of a letter when it is held down too long.
- If a student has visual impairments, speech output, screen magnification, or Braille input with text-to-speech translation can be integrated into the lesson for the student to use. The screen magnification would be beneficial for viewing the different sound waves.
- If a student has a learning disability and has a more difficult time using the technology than other students, other classmates can help assist the student and more precise instructions can be given.