Date: February 5, 2013 1:30pm

Lesson Title: Integrating Music and Mathematics

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| Curriculum Area (s): Music Methods | Author: Kayla Brinston, Jordan Gallant, Sarah Galvin, Jason King, Mallory Sharpe, Rebecca Steeves |
| Grade Level: B.ED | Author Contact: BMH 205 |
| Time Required:50 minutes | Instructional Groupings: mixed groups |
| Objective: | |
| To provide pre-service teachers with a number of strategies for integrating the Mathematics and Music curriculums. | |
| Materials: | |
| Smartboard (Display Team information, list of groups and timer), 5 sets of cards and 5 envelopes for the engagement activity, song “There was an Old Lady Who Swallowed a Fly” by Raffi, sound system on which to play the music.  Other required equipment will be listed with the individual mini-lessons. | |
| Overview: |  |
| The students will very briefly be introduced to the idea of integrating the subjects of Mathematics and Music. They will then do an engagement activity. The students will then be split into 4 groups and will rotate through 3 stations, leaning strategies for two grades at each station (K-1, 2-3, 4-5). The lesson will end by returning to our seats for a quick class discussion to wrap things up. | |
| Know (facts, vocabulary, how-to's, information that is memorisable) | Do(Skills) (thinking skills, skills of the discipline - skills you will assess) |
| * Various strategies that can be used to integrate Music and Mathematics | * Pick activities that will enrich their students’ learning experiences. * Be able to teach using some basic strategies that integrate mathematics and music. |
| Steps in the Lesson: | |
| **Introduction: (3 Minutes)**  When teaching math using music there are many benefits since these two subjects are actually closely related.  Studies have suggested that teaching these two subjects helps students increase spatial-temporal reasoning skills, for example geometry and proportional reasoning, which many students struggle with.  Additionally, psychologist Howard Gardner identified musical ability as one type of intelligence and therefore its incorporation into other subject areas can only enhance student learning.  When integrating these two subjects there are some important similarities that should be taken into consideration.  Patterns are prominent in both math and music and can be taught together easily especially when using rhythmic patterns.  Serial order, sorting and classifying can be used to teach math concepts by using instruments, rhythms, and songs.  The math concept of ratios can be taught through different numbers of instruments in a band or group and how this affects the sound, or by comparing the different parts of an instrument.  Students can graph the results of musical experiments. By measuring different instruments or strings students will begin to understand how important measurement is when creating instruments.  The way music notes are divided into beats provides a wonderful instruction tool for teaching students the concept of fractions.  When incorporating the teaching of math and music it is important to remember that there are three overarching components that make up the music curriculum, creating, understanding the components of music, and responding to music.  If you use these three ideas to guide you when using music in the classroom the students will get more from the learning process and it will help them relate what they are learning to the real world in which they live.  **Phase 1 – Engagement Activity: (3 Minutes)**   * Let students sit at their desired table at the beginning of the lesson (They will be grouped after the engagement activity. * Give each group an envelope with 5 cards inside, and instruct them to leave it in the centre of the table until instructed. * Inform students that they will be listening to a song. * Play “There was an old lady who swallowed a fly” for the students. * When the song ends have students open the envelop in the centre of the table. * Place the pictures in the order that they occurred in the song. * The “teacher” will then ask that the group hold up the second (First, third, etc.) card. * Students are practicing using ordinal numbers, placing things in order while learning about form and listening critically to music.   **Phase 2 – Knowledge Content (40 minutes)**   * Students will then be assigned groups and will move to a designated area of the classroom. * Students will partake in two six minute mini-lessons before rotating to the next station. * Mini-Lessons: **See below** * Teachers demonstrate and students participate in the mini-lessons. | |
| **Follow-up & Assessment**  **Class Discussion: (4 minutes)**   * Does anyone have any activities that they used during their internship, to integrate Mathematics and Music, which they would like to share with the class? * Are there any activities that people are particularly keen to share with their classes in the future? * Which areas of mathematics do you think students would find music integration the most beneficial? * Which is scarier to you, the math or the music? Would you find it difficult teaching any of the strategies presented? | |
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**Station K-1** (12 min)

Learning Shapes with the Hokey Pokey

## Mallory Sharpe

NCTM  
Content Standards: Space and Shape (SS)   
Process Standards:  [C, CN, PS, R, V]  
NB Mathematics Curriculum Kindergarten  
Strand: (SS)  
GCO: Shape and Space (SS): 3-D Objects and 2-D Shapes      
SCO: SS2: Sort 3-D objects using a single attribute.  
Grade Level/ Subject: Kindergarten Mathematics

# NB Music Curriculum K-5

GCO 8: Students will be expected to analyse the relationship between artistic intent and the expressive work. Outcome: 1.8.1 explore reasons for making music in the school and community.

Time:30 minute lesson (6 minute activity for presentation)  
Purpose:The purpose of this activity is to familiarize students with 3D objects.   
Objectives: As a result of this activity, students will be able to recognize 3D shapes using music.  
  
Resources:  
[**http://lessonplanspage.com/MathMusicHokeyPokeyShapesIdeaPK.htm/**](http://lessonplanspage.com/MathMusicHokeyPokeyShapesIdeaPK.htm/)  
  
Materials:  
prisms, pyramids, cones, cylinders, and spheres for each student  
Hokey Pokey song (without words)  
<http://www.youtube.com/watch?v=rB47OZY2lTw>  
  
Activities and Procedures:

1. This lesson will be review from yesterday’s lesson on 3D objects. The teacher will hold up each object and ask students to identify them.
2. Students will each be given a prism, pyramid, cone, cylinder, and sphere.
3. The teacher will have all the students sit in a circle with the 3D objects in front of them.
4. The teacher will ask anyone if they remember what the Hokey Pokey song is. Teacher will go over what the Hokey Pokey song is.
5. The teacher will explain that they are going to use the Hokey Pokey song to help remember the 3D objects.  (Demo the song before)
6. The teacher will have the students line the 3D objects in order of prism, pyramid, cone, cylinder, and sphere.
7. The teacher will start the Hokey Pokey song and put the prism in first, then the pyramid and so on until the each object has been a part of the Hokey Pokey song.
8. Next the teacher will tell students that the order they have the objects will no longer matter because the song will be random.

The teacher will sing the Hokey Pokey song with a random order of the 3D objects until each one has been involved in the activity.

Assessment:  
**Formative, guiding question:**  
**·** Was student able to recognize the 3D object?  
  
Differentiation:  
Students who excel in learning verbally, kinesthetically and musically will benefit from this lesson. All students will be able to participate in this activity because by this time they have all learned the Hokey Pokey song and for those who have not been introduced to it the teacher goes over it. The teacher also reviews each shape before the activity begins and has them in order of how the song goes. The second time the song is sung the students do not know what order the shapes will come in. For the majority of this activity the students are engaged because they are singing and have to pay attention to know what shape will come next.  
  
Enrichment/ elaboration**:** For students who are excelling in this activity the teacher could have them sing the song. Students can volunteer to take turns being the teacher.

Developing Name Patterns

## Sarah Galvin

NCTM  
Content Standards: Patterns and Relations  
Process Standards: Communication, Visualization, Problem Solving  
  
NB Mathematics Curriculum Grade 1  
Strand: (PR)  
GCO: Patterns and Relations: Use Patterns to describe the world and solve problems

SCO:  PR1: Demonstrate an understanding of repeating patterns (two or four elements) by: describing, reproducing, extending, creating

PR2: Translate repeating patterns from one representation to another.

# NB Music Curriculum K-5

GCO 8: Students will be expected to analyse the relationship between artistic intent and the expressive work. **Outcome: 1.8.1** explore reasons for making music in the school and community.  
  
Grade Level/ Subject: Grade 1 Mathematics  
  
Purpose: The purpose of this activity is to familiarize students with simple patterning as well as counting syllables.  
  
Objectives:  
As a result of this activity, students will be able to recognise how many syllables are in their names and how to create a simple pattern using these syllables.  
  
Resources:  
Johnson, G. L., & Edelson, J. R. (2003). Integrating Music and Mathematics in the Elementary     Classroom. *Teaching Children Mathematics.* Retrieved from:      http://lesage.blogs.uoit.ca/wp-uploads/2010/08/Integrating-Math-Music-2003NCTM.pdf  
  
Materials:Drum, cards, markers and stickers.  
  
Activities and Procedures: **(6 minutes)**

1. Have students sitting in circle and pass around an instrument. Introduce the instrument (maraca or drum) and show students how to use it properly. Say that we are going to use this instrument (drum) to figure out how many syllables are in our names. Do an example with teacher’s name (sar-ah), meaning there are two syllables.
2. Tell students to take turns beating the number of syllables in their names with the instrument and say their name with the beat while the other students listen carefully.
3. Ask the class to predict if more people in the class have two syllables, one syllable or three syllables.
4. Go around again; but this time, ask class how many syllables there are in each name. When the class decides, represent this by giving each student a card with the same number of bumps as they have syllables in their names.
5. Next instruct them to order themselves in a pattern selected by the teacher. Represent this on the board with humps at first. Example: one syllable, two syllables, one syllable, two syllables.
6. Have students sing their syllables in the pattern, passing down the instrument.

Assessment:  
Formative, guiding questions:

* Was student able to recognize how many syllables were in their name?
* Was student able to order themselves in simple pattern?

Summative:

* Fill in the blank of the following name pattern if the pattern went one syllable, two syllable, one syllable two syllable

Sarah, Sam, Kali, \_\_\_\_  
Jason or Chris

Differentiation:

* This activity differentiates towards students who benefit from musical instruction. The class will not move on until all students know and understand how many syllables are in each student’s name.
* This activity is also great for the age group of students because they tend to have a shorter attention span. This activity does not take that long to do and students are engaged because they each have a turn to speak and plan the instrument.
* Students work together as a class to organize each other into the pattern so students who are struggling will find support from their classmates.
* This lesson also speaks to spatial/kinesthetic/bodily learners as well due to the movement involved when creating patterns.

Enrichment/ elaboration:For students and classes that catch on quickly, they can create a sticker graph using stickers to represent how many syllables students have in their names. Create 4 sections, one for one syllable, one for two syllables, one for three syllables and one for students who have four syllables in their name.  

**Station 2-3** (12 min)

Patterning with Music (AABA)

## Jordan Gallant

NCTM  
Content Standards: Understand patterns, relations, and functions    
Process Standards:

* sort, classify, and order objects by size, number, and other properties;
* recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another;
* analyze how both repeating and growing patterns are generated.

NB Mathematics Curriculum Grade 2  
GCO: Patterns and Relations (PR): Use patterns to describe the world and solve problems  
SCO:   PR1: Demonstrate an understanding of repeating patterns (three to five elements):

PR2: Demonstrate an understanding of increasing patterns:

(for PR1 and PR2) by

* describing
* extending
* comparing
* creating

patterns using manipulatives, diagrams, sounds and actions (numbers to 100)

[C, CN, PS, R, V, ME]

NB Music Curriculum Grade 2  
GCO: Patterns and Relations (PR): Use patterns to describe the world and solve problems

SCO:  2.1.4 explore a variety of rhythmic/melodic concepts and forms to create, make, and present music

           Same-different form and AABA

# Grade Level/ Subject: Grade 2 Mathematics

# Purpose:

In this lesson, students will further develop their ability to recognize and create patterns.  This activity asks students to recognize and create the elements, attributes, core and extensions of a pattern using an AABA musical pattern.

# Objectives:

* To have students point out the core and elements of a musical AABA pattern based on their previous knowledge of patterns.
* To recognize that patterns require at least three repetitions of a core (ie. AABA x3)
* To have students recognize an AABA pattern alongside ABAB and ABBA patterns.
* To have students create their own AABA pattern using instruments.

Materials: various musical instruments (tambourines, maracas,  drums, etc), mini white boards, erasable markers, whiteboard eraser  
  
Activities and Procedures:

1. Create an AABA pattern using two instruments or vocals and play 3 times through
2. (ie. Drum-drum-drum- drum, drum-drum-drum-drum, whistle- whistle- whistle- whistle, drum-drum-drum-drum x3)
3. Ask students was that a pattern? (Yes)  How do we know (it has a core, attributes, and elements and repeats at least 3 times) What were the elements? (There were 2: drum & whistle) Have a volunteer show you what your core was (as above only once).
4. Point out that we can write our pattern down by calling the first sound we hear “A” and the second “B”. Ask students to listen again and write the pattern they hear on their whiteboards. Remind them that the sounds are grouped in fours in your song. Play the core three times with definite breaks between cores for students to formulate a guess.
5. Review the pattern AABA by looking at what the students have written down and having them speak the letters alongside the sounds. (AAAA-AAAA-BBBB-AAAA)
6. Show them another AABA pattern that is more complex.(ie. la-la-do-op, la-la-do-op, di-do-di-do, la-la-do-op) and check again if students understand that AABA pattern using whiteboards.
7. Then attempt to show them an AABA pattern alongside an ABBA or ABAB pattern and have them point out which one was the AABA.
8. Have instruments laying out for students to try to create their own AABA pattern to show the group.

Assessment:  
This activity can be used as an assessment at any point in the day, as the teacher can create a pattern and ask the class to raise their hands, write down, etc if it is AABA. The teacher can record student understanding on a checklist or collect student responses in written form.  
  
Differentiation:  
This activity uses music to provide differentiation to those with a musical intelligence. Patterning can also be done using musical instruments that kinesthetic learners place in AABA hoops laid on the floor (perhaps with one color for “A” and another for “B”) and then move through to play each for an equal number of beats. Students may also choose to make sound using their bodies as a part of their pattern.  (ie. Tap x3, Tap x3 , Snap x3, Tap x3…)  
  
Enrichment/ elaboration:  
Students can look for popular songs that follow an AABA pattern (see “Somewhere over the rainbow”) to present to the class during a mat time.

Exploring Measurement and Sound

## Rebecca Steeves

NCTM  
Content Standards: Shapes and Space  
Process Standards: C, CN, ME, PS, R, V  
  
NB Mathematics Curriculum Grade 3  
GCO: Shape and Space: Use direct or indirect measurement to solve problems

SCO:  SS3: Demonstrate an understanding of measuring length (cm, m) by:

•  selecting and justifying referents for the units cm and m

•  modelling and describing the relationship between the units cm and m

•  estimating length using referents

•  measuring and recording length, width and height.

    SS1: Relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years).

# NB Music Curriculum K-5

GCO 5: Students will be expected to examine the relationship among the arts, societies, and environments  
  
3.1.2 explore a range of materials and techniques to create, make and present music  
3.7.2 identify sound sources and their expressive effects

# Grade Level/ Subject: Grade 3 Mathematics

Purpose: The purpose of this activity is for students to understand when to use centimeters or meters when measuring an object.  
  
Objectives:  
As a result of this activity, students will be able to recognise and know when to measure an object using centimeters or meters.   
Students will be able to estimate the length of the string.  
Students will be able to understand that the pitch of an instrument varies depending on the measurement of the string  
  
Music Objectives:  
Students will be exposed to different instruments  
Students will be able to identify pitch changes due to the length of a string.  
  
Resources:  
Johnson, G. L., & Edelson, J. R. (2003). Integrating Music and Mathematics in the Elementary     Classroom. *Teaching Children Mathematics.* Retrieved from:      http://lesage.blogs.uoit.ca/wp-uploads/2010/08/Integrating-Math-Music-2003NCTM.pdf  
  
Materials:meter sticks, string, rulers, violin, trombone, trumpet, sheet to record length and pitch of the strings  
  
Activities and Procedures: (30 minutes with Students) [6 minutes for demonstration]

1. Show students the trombone and trumpet and ask how long they think the instruments are. Then discuss how we use standard and non-standard methods to measure things by.
2. Ask students what units we use to measure things.  (answer should be centimeters and meters) Show the difference between these two units of measurement.  Now ask students which unit of measurement would be used to measure the trombone versus the trumpet.
3. Explain that in music we can have high pitches and low pitches.
4. Give students pre-cut strings of certain lengths that will need to be measured using centimeters and meters and identify the pitch as high, medium, and low in pairs.
5. Students will fill in a chart by placing the lengths of the string in order of the lowest to highest pitches
6. Demonstrate for the students the pitches produced at various levels on the violin string depending on where the finger is placed.  Ask the students if they think(based on their previous findings) the sound will be higher or lower at the different points indicated.  Check to see if they are correct.  Ask them to estimate how many centimeters and then check the answer using the ruler.

# Extension

Students may create a melody using the different strings they used to measure and record the pitch.

Assessment:  
Formative, guiding questions:

* What are some other instruments that you would need to measure in meters?
* Was the student able to choose whether to measure using meters or centimeters?
* Was the student able to notice if the pitch of the string sounds higher as the measurement decreases?

Summative:

* Check to see that the students measured the strings correctly and were able to identify if the pitch was high medium or low after they hand this in.

# Differentiation:

* This activity differentiates towards students who benefit from musical instruction.
* Some students may struggle with identifying whether a pitch is high medium or low.  This is fine since the purpose of the lesson is for students to understand the difference between using centimeters or meters to measure an object. This can also be used as a teaching moment to explain the benefits of using a standard unit to measure things. To help students with this concept, have them compare the sounds of the strings at different lengths, this way they are not just trying to decide without having something to compare the sound to.
* This activity is done individually so students are able to try using both types of measurement when completing the measurement tasks so they are able to learn by experimenting and then making a decision.  This way the activity differentiates on its own.
* This lesson gives students the ability to discover different types of measurement and create sounds on their own.  Through the variety of methods, each student has the opportunity to experience and learn the subject matter in a way that suits them.

Enrichment/ elaboration:For students and classes that catch on quickly they can create songs using rhythm and pitch of the strings they have been given.  This gives students a practical application of how important it is for a measurement to be correct and the benefits of a standard unit of measurement. Students can also explore measuring other types of instruments and how the length of the instrument may affect the pitches it creates.

**Grade 4-5** (12 min)

Adding Fractions using Musical Notes

## Kayla Brinston

NCTM  
Content Standards: Number Sense  
Process Standards: Communication, Visualization, Connections, Reasoning, Problem Solving  
NB Mathematics Curriculum Grade 4  
Strand: (N)  
GCO: Number: Develop Number Sense

SCO:  N8: Demonstrate an understanding of fractions less than or equal to one by using concrete and pictorial representation to:

* Name and record fractions for the parts of a whole or a set
* Compare and order fractions
* Provide examples of where fractions are used

# NB Music Curriculum Grade 4

GCO 1:Students will explore, challenge, develop, and express ideas, using the skills, language, techniques and processes of the arts.

SCO: 4.1.5: create and notate short musical works to express musical thoughts and ideas with an emphasis on question and answer phrases

Time: **40 minute lesson (6 minute presentation for class)**

# Grade Level/ Subject: Grade 4 Mathematics

Purpose: The purpose of this activity is to use music notes and measures as a way to demonstrate how to add fractions

Objectives:  
As a result of this activity, students will be able to provide examples of where fractions are used (in music).  Students will be able to visually, kinaesthetically and audibly be able to represent the addition of fractions using musical notes.  
  
Resources:  
Hopkins, G. (2009). Music and math: Create a clapping symphony (Plus fraction math).

*Education World*.  Retrieved from:<http://www.educationworld.com/a_lesson/03/lp303-5.shtml>.

Materials:anchor chart of note values, markers, flipchart or whiteboard  
  
Activities and Procedures:

1. Introduce lesson: today we will be learning the pictorial representation of notes and their values.  We will see how each note has a value that correlates to a mathematical fraction.  We will use musical notes to demonstrate how to add fractions.
2. Show anchor chart and explain the what each notes represents: whole note (1), half note (1/2), quarter note (1/4), eighth note (1/8).  Anchor chart has three columns: name of note, visual representation of note, representation of note in fraction form
3. Now we will represent that notes using clapping and snapping.  A whole note has four beats: clap snap snap snap; a half note has 2 beats clap snap clap snap; a quarter note has 4 short beats: clap clap clap clap; a eight note has 2 claps for each beat: clapclap, clapclap, clapclap, clapclap (DEMONSTRATE)
4. Teacher will then clap notes at random and have students identify which note is being represented.
5. On flipchart teacher will write fraction equation such as ¼ + ¼ = \_\_ student will fill in blank with 2/4 or ½ and represent the answer with a musical note (half note in this case); 1/8 + 1/8 = 2/8 or ¼ (quarter note); ½ + ½ = 2/2 or 1 (whole note).  Have students clap out answers

Assessment:  
Formative, guiding questions:

* was the student able to represent the fraction in claps
* was the student able to identify which fraction was being represented by a pictorial representation of a musical note and by hearing a pattern of claps
* was the student able to add musical notes and see how it relates to a fraction

### Summative:

* Fill in the blank of the musical note
* Students are able to give the answer for a fraction equation

# Differentiation:

* This activity is created to benefit students who enjoy musical instruction.
* The lesson includes many activities to reinforce the idea and keep the student’s attention
* By clapping, students are engaged and need to be paying attention
* Teacher will not move on to the next step until all students understand
* This lesson works with visual, audio and kinesthetic due to the visual anchor chart, the sound of the clapping and the movement of their hands

Enrichment/ elaboration:If students complete these activities the teacher can increase the level of difficulty by introducing the sixteenth note.  The teacher can also clap out equations and have the students write down what they hear and answer the equation by representing the answer with claps.  For example, “clap, snap, clap, snap + clap, snap, clap, snap (½ + ½ = \_ ) = clap, snap, snap, snap (1)

Finding Ratios in Music

## Jason King

Introduction  
NCTM  
Content Standard #1: Measurement Standard  
Process Standards:

·         understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute;

Content Standard #2: Number and Operations

·         develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers;

·         recognize and generate equivalent forms of commonly used fractions, decimals, and percents;

New Brunswick Mathematics Curriculum Grade 5  
Content Strand: Measurement  
GCO: Shape & Space (SS): Use direct and indirect measurement to solve problems  
SCO: **SS2** Demonstrate an understanding of measuring length

**GCO: Number (N): Develop number sense**

SCO: **N7: Demonstrate an understanding of fractions by using concrete and pictorial representations to:**

•  **create sets of equivalent fractions**

•  **compare fractions with like and unlike denominators.**

[C, CN, PS, R, V]

New Brunswick Music Curriculum Grade 1-5  
GCO 2: Students will be expected to create and/or present, collaboratively and independently, expressive products in the arts for a range of audiences and purposes.  
  
  
  
Overview  
Proportional reasoning (including: ratios, percent, and fractions) is one of the unifying themes in mathematics; however it is estimated that fewer than 50% of adults are proportional thinkers.  We use proportion every day, even when we first learned to count.  One object represented one number, a ratio of 1:1.  In baseball ratios are also very prevalent. Think of times at bat to times hit.  Even though this number, batting average, is usually represented by a decimal value it is still a ratio.  If a student is comparing the number of red marbles they have to the number of blue this is also proportional reasoning.  It is not an exaggeration to say that students are exposed to ratios/proportional reasoning numerous times in the run of a day.  Unfortunately, even though there is such a strong connect to our everyday lives, students often find the application of the skills, we all already have, very difficult in mathematics class.  That is why it is important to teach this skill using as many of the multiple intelligences as possible; we need to reinforce these skills.  
In this lesson we will also review measurement, as measuring is important to the activities planned.  Measurement is one of the most prevalent and useful content areas in mathematics.  It is a skill that can be applied to almost every ones daily life.  We use measurement on regular basis in areas from occupational tasks to life skills.

Purpose  
In this lesson, students will further develop their understanding of proportional reasoning and measurement.  Students will have the opportunity to participate in two activities that will engage their bodily-kinesthetic and musical intelligences to help reinforce what students have been learning.  The first activity involves looking at stringed instruments and the length of the neck of the instrument in relation to the length of the stop (portion of the body of the instrument under the vibrating string from the base of the neck to the bridge) and the length of the vibrating string.  The second activity was inspired by African and Afro-Cuban drum music with two strong simultaneous rhythms (clave and drums, clave and piano). The students could start by listening to a Tumbao (Salsa Montuno) as an example of this type of music.  The students will then create music of their own and look for the ratios in the rhythm and the Lowest common multiple (LCM)  
  
Objectives  
As a result of these activities, students will be able to:

* 1. Recognize that ratios are all around us; that length and rhythm and two places where we often see ratios.
  2. Use reasoning skills to explore proportional (multiplicative not additive) relationships.

Assessment  
No formal paper and pencil assessments will be given during this lesson.  Formative assessment of students ability to grasp the content will be given in the following manner:  
Activity 1 - Students will be able to demonstrate that they are able to measure the instrument and record a ratio based on length.  
Activity 2 - Students will be assessed based on participation, effort, and ability to recognize the ratios in the beat and rhythm.

Resource Materials  
Activity 1 - Guitar, ukulele, violin, and cello (or scale drawings of each).  Students will also need some sort of standard unit measuring device (rule, measuring tape, etc.).  
Activity 2 – Example of Tumbao or Bembe Ostinato music, various musical instruments.  Instruction sheets.

Development  
Activities and Procedures

* Teacher will inform students (other pre-service teachers) that they will be quickly reviewing two different techniques that they can use to teach students about ratios in class.

## Activity # 1

1. Students pair up – If a class of children was being taught the teacher could group based using numbered heads or numbered cards.  In this situation where the class of adults is already separated into smaller groups, they can pick with whom they wish to work.
2. The teacher asks the students if they can identify certain parts of the instrument.  If they cannot then the teacher explains the parts (Nut, string, vibrating string, stop, neck, and bridge).
3. Groups are each given a stringed instrument (or scale picture of one if instruments are not available).
4. Students then measure the vibrating portion of the string.  Then they measure the length of the neck of the instrument.  Finally**,** students measure the length of the stop.
5. Students then record three ratios – Neck to stop, neck to vibrating string, and stop to vibrating string.
6. Students are then asked to share the information they recorded and asked what similarities and differences they can see between the ratios of each of the stringed instruments.
7. Students will then be able to use the musical instruments during the second activity to make their own music.

## Activity # 2

1. Students will start by listening to an example of African/Afro-Cuban drum music that is characterized by two distinct beats.
2. Students will then practice slapping there laps to a 4/4 beat.
3. Two students will be selected from the group and asked to pick a musical instrument.  Each student will be asked to sound their instrument on a selected beat.  For example student 1 will sound their instrument every 3rd beat and the second student will sound their instrument every 4th beat.
4. The other students will slap out the 4/4 beat for 4 measures.
5. Then determine the lowest common multiple (LCM) for the instruments and the ratio of their instruments sounding.
6. Repeat the activity with a different ratio and LCM.
7. Have the students create their own music and find the LCM and the ratio.  Students can experiment with different time signatures as well.

Adaptations  
  
As this lesson is asking students to use several different skills, instead of introducing an algorithm, all students should be able to participate.  However, some students will find concepts easier, while others struggle more.  This lesson uses different intelligences to convey the material.  The fact that there has been auditory, bodily-kinesthetic, musical, and logical-mathematical learning will help more students absorb the material.  
If students are working above grade level, they can be asked to create more complex compositions or add in additional instruments on the second activity.  
If students are struggling with the material, then several adaptations can be made.  We can pair with those who have complementary skills.  The students can be given extra time to complete the activities.  The teacher can scaffold the learning by repeating or writing down the pattern in the second activity or by assisting the students with the measurement in the first activity.

Follow-Up  
Tying it All Together

1)  Students will be asked to reflect on the process.  Guided questions will be used to stimulate conversation.  What have we learned about where we can see ratios in our everyday lives?  Can you think of any other examples of ratios you see in your everyday lives?  How can the LCM help us find the ratio?

References

Johnson, Gretchen L., & Edelson, R. Jill (2003).  Integrating Music and Math in the Elementary Classroom, Teaching Children Mathematics, April 2003, Volume 9, Issue 8, Page 474.  
*From this article I got the idea of measuring instruments and using the measurements to make ratios.*  
  
Stevens, Anthony C., Sharp, Janet M., & Nelson, Becky (2001).  The Intersection of Two Unlikely Worlds: Ratios and Drums, Teaching Children Mathematics, February 2001, Volume 7, Issue 6, Page 376  
*This article introduced the rhythms of African and Afro-Cuban drum music.  I created Activity #2 based on this information.*