Math to the rhythm

Summary

Age category
6 - 8 years
Topic
Measurement
Numbers & operations
Total duration
470 minutes

Students create musical instruments using recycled materials and compose a rhythm that will be played with their instrument.

Problem(s) to be tackled:

Each group will write a 4 seconds' composition and link it to the compositions of the other groups. The final song will be played at the next school-event.

Real context

Real-world motivation

We are surrounded by noises, by sounds, by music... But, what do we know about what sound is? and how music uses sounds? With this activity we will deepen our knowledge on these topics.

- What is sound? How do we make different sounds?
- How do we measure time?
- What does it mean to "double/halve" the speed of something?
- What is a rhythm? How can we compose a beat?

Goals

Skills

- Listen and distinguish sounds with different timber, pitch (low/high)[1] and rhythm.
- Move or clap at the rhythm of a clock or a beat.
- Familiarize with the concepts of double and half as the respective ratios of 1:2 and 2:1.
- Measure time in seconds and familiarize with the equivalence 60 seconds = 1 minute.
- Cooperate as a group.

[1] Traducción al español: registro (alto/bajo)

stem4math

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Note to translators in other languages: do NOT use “tone” as in do-re-mi, but the term referring to the frequency (hz) of the noise.

Knowledge

- Understand that the sound is a vibration and a form of energy.
- Familiarize with the scientific process and the trial and error procedures to investigate.
- Measure time with non-standard tools like playing a rhythm or a song.

Methodology

Part	Description	Timing
1	**Introduction** The teacher introduces the concept of sound as form of energy and a vibration with, for example, this videos: https://youtu.be/ik8jICj8juc https://youtu.be/-MjTNwXKzMc Children should be encouraged to move and follow the rhythm with their bodies.	10'
2	**What makes sound?** Children work in pairs to find different objects in the classroom and make more than one sound with them. They should explore how to produce different pitches with the same object (e.g. knock on a radiator while touching it or tap on different sized card boxes).	15'
3	**How does sound work?** (If the teacher wants to deepen his/her knowledge about the physics of sound, the following TED Ed lesson might be helpful https://ed.ted.com/on/paboC6AU) With the help of the teacher, the children compare different timbres, which depend on the materials, paying attention to how metal, cardboard, plastic or wood sound. The teacher plays some short and repeated rhythm (ex. Black-black-white, black-black-white). Note that, depending on the country, different syllables are used to sing these rhythms. If the music teacher is using some sort of language for these, the same language should be used. Otherwise, you can simply use “TI” for an eighth note, “TA” for black and “TAM” for white. The groups in turns repeat the same rhythm both singing it and with the object they have found. If the children can play in synch, two or three groups can play at the same time. Either the teacher or some students can become the conductors of the improvised orchestra.	30'

4	**Story time!** (Optional) If the book ADA's Violin by Susan Hood is available, it should be read out loud and discussed. (Optional) The following pages can be a good introduction to the early ages of sound that can be of interest to the children: https://www.livescience.com/20563-ancient-bone-flute.html https://en.wikipedia.org/wiki/Bullroarer	30'
5	**Research & Design** Children research online or in books how to make instruments with different materials. They should make a sketch on how their instrument should be. They have to be guided to achieve the goal of having a two-pitched instrument. If needed by younger kids, the teacher can provide materials and let them experiment with them. (Here are a pair of examples How to make a kazoo: https://carrotsareorange.com/sound-science-activity/ https://www.pinterest.es/pin/259660734740383193/) The teacher should be very careful introducing the right wording for big-medium-small when talking to each group depending on what they are using for the pitch: length (long/short), capacity (full/empty), volume (tall, wide, deep), etc. Each group should finally produce a list of materials that they will need for their instrument. (The teacher needs to decide whether the school or the families should provide the materials and make the arrangements to obtain them.)	90'
6	**Construction** Instrument construction, decoration and testing according to their sketch. If the group makes substantial changes on their first sketch, they should discuss and give a justification of the changes to the teacher, who will decide either to accept the changes or encourage them to stick the original plan. Enough time should also be given for the children to decorate, name and engage with their instruments.	90'

7	**Figure exchange** Black figures (TA -) represent a 1-second beat; white figures (TAM -) a 2-second beat; while the ½ second beat will be represented by the black-tilde figure (TI -).[1] If children have difficulties understanding the relationships between figures, manipulatives can be given to them (like pink, red and white Cuisenaire Rods). The teacher explains the rules of the game, where 2 TA figures can be exchanged for 1 TAM or 2 TI figures can be exchanged for 1 TA. They will sing, play or beat to some rhythms proposed by the teacher. For example, the teacher shows the kids “TA-TA-TA-TI-TI” and the whole class needs to clap that rhythm in 4 seconds. The kids propose some 4-seconds rhythms and the class reads them until the children familiarize with the equivalences. Each group of children is either given 4 TAM, 8 TA, or 16 TI in order to prepare two rhythm proposals, each of them 4-seconds long. They are encouraged to ask other groups for figures in order to create their rhythm respecting the 2:1 ratios between figures and the total 4-seconds length in each proposal. The teacher should have additional figures in order to provide with enough variety, but exchanges among them should be encouraged at the beginning. Once each group has their two proposals, they play them to the rest of the class and the whole class chooses one of them for the concert. (Children should write down their rhythms when they are finished before returning the materials to the teacher.) [1] Note for translation: If your language uses fractions to name these figures, try to find the usual convention in your country when teaching rhythms to the children. Avoid the use of fraction names for the conventional Taa, Tiki, etc.	60'
8	**Time measurement** Discussion and research about how we measure time should be introduced. Either online or with teacher-provided books, children should think about time measurement. Time is the first non-manipulative magnitude children are introduced to and special care should be put on introducing non-standard units such as “the time it takes us to sing happy birthday” or “the time it takes you to go from side to side in this classroom”. After discussing traditional ways of measuring time (sun, water, sand, etc), the concept “second” can be introduced as the usual standard unit for time measurement. Either with a real metronome or any metronome app, the teacher can play with the children to perform different actions following the beats with different frequencies. Then, they can play their 4-seconds proposals at different speeds depending on the metronome.	45'

9	**Concert rehearsal** Following the paper where they have written their rhythm, enough time is given to the children for rehearsal. They should be able to play their composition twice in a row with the instrument they have built (elder kids may also chose to use the different pitches in their instrument). When all groups have internalized their composition, we can start playing in turns: The teacher acts as the conductor giving enough time to each group to play their rhythm several times and skipping to the next group rhythmically. Depending on the children's ability to perform, several groups can be asked to play at the same time.	45'
10	**Reflect on the learning** Some minutes should be reserved at the end of the lesson for a final reflection on the learning.	10'
11	**Concert** The end result may be played at some school event for the children to feel proud of their work and the instruments be exposed at teacher-parents meeting or school corridors.	45'

Organization

Materials

There are not special materials needed. The children prepare the list of materials than they need to make the instruments and use trash materials

Grouping

• Groups consist of three students.

• Attitudes needed in a group:

Creativity

Kinesthetic abilities/Body coordination

Coaching

Useful questions

- From the moment you get up to the moment you go to bed you're hearing sounds. Do you know what they are? How are they produced? (Sound description).
- Do you know other musical groups that sound similar to STOMP?
- Do you ever make sounds just for fun? What do you do them with? How do we call a sound that we do not like?
- Can we obtain different noises/sounds from the same object?
- What is an instrument?
- Why do you think you are usually asked to stop when you are making noise? What is the difference between noise and music? / Noises are unpleasant sounds, which ones bother you the most? (Noise pollution, to talk about respect).
- How do we measure time? Why is it so difficult to measure time? Can we touch the time?
- What units do people use to measure time? Can you imagine if we measured time in songs, poems or running laps around school?

- How do you think that noise, sound and music relate to math? What is a rhythm? For how long can you tap a rhythm without losing the pace? Does it depend on what rhythm you are tapping to?
- Why do you think we are using recycled materials for this project? How were the first musical instruments used by humans? (bullroarer, bone flute). When you play the flute, why are more and more holes being plugged to play the lower pitch sounds? (Children should reflect on the length of the tube).

Adaptions (abilities of age-group, within the group, ...)

Highly sensitive children may be allowed to bring earplugs to “noisy” sessions.

Assessment

Teacher's assessment

Did all students engage in the activity? Have all groups worked respectfully and productively? Do all kids understand and use correctly the concepts of double and half? Can the children reflect on the sound in a more profound way than when the activity started? Did the children know what I was expecting from them along the sessions? Were my questions well suited for their reflections and encouraged a significant learning?

Student's assessment

We include a printable rubric to assess each child’s performance that can be at reach during the whole project to help the children self-evaluate their own performance.

Other than the formative assessment during the project, the printable with the final reflection might be of use to have a deeper conversation with the kids individually and evaluate their achievement. It must be noted though that the reflection is NOT intended to be understood as a final exam or instrument for quantitative evaluation.