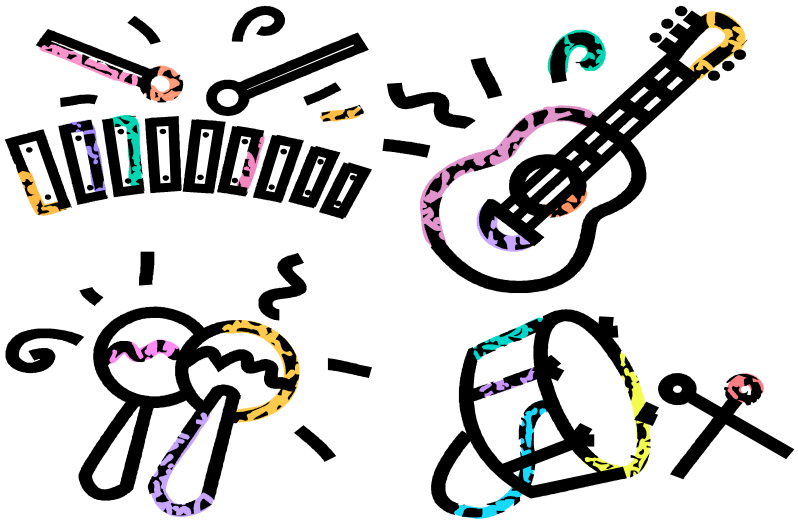
Working Document

centre de développement pédagogique
pour la formation générale en science et technologie

Music!



TEACHER'S GUIDE

September 2008

PREPARATION
Activity 1
Objective: Have the students listen to various instruments

Material:
Real instruments or store-bought toy instruments.

Duration: 20 minutes

The teacher uses different musical instruments to explore different sounds it is possible to obtain by blowing into, striking, or pinching cords of an instrument, etc. The teacher must underline high and low sounds.

IMPORTANT: Ensure that you present instruments from each of the main families (wind, cords, percussion). That way, the students will not be influenced while planning their experimentation.

Alternatively, it may be interesting to have the students listen to sounds issued from different instruments.

Possible questions to be broached with the students:
What can influence the sound of an instrument? (dimension, material, force applied,…)

NOTE:
Auditory perception will be different for each student, so it will be necessary to specify to them what a high or low sound is.

Activity 2

Objective: Elaboration of a hypothesis (preliminary explanation)

Material:

- **Student booklet, p. 1**

Duration: about 30 minutes (depending on the ability of the students to formulate a hypothesis)

The teacher puts forward the problem and asks them to give their explanation orally initially. He or she may then draw up a few on the board to model a complete explanation. If the students are not familiar with composing preliminary explanations, they must be taught to do so.

Next, he or she asks the students to write their preliminary explanations in their experiment booklet. The students must then think about the material necessary to the demonstration of their hypothesis.

It would be preferable for the students to write their explanation individually. They may however, undertake their experiments in teams.

The scientific concept to be worked on is the notion of the variable, explained on the following page.



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Student's name: _____ Group:_____

My scientific investigation process

Music!

How do we obtain high and low sounds?

To pose a question

My hypothesis

I think that:

I think it because:

Imagine an explanation

How much time I have:

Individual or team work:

Material to be foreseen:

Material available to me:

Plan your process

On the following page, describe or draw the experiments you want to carry out in class. This will help you to foresee what material you will need!

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Example of a verifiable hypothesis related to the table at right:

"I think that smaller tubes are not as loud as bigger tubes. I think this because my mother plays the recorder. She has two, a small one and a big one. The smaller one sounds brighter than the bigger one".

Example of an experiment related to the variables in the table:
In this case, the student can carry out an experiment by setting factors that don't change "*tubes made of the same material and the same length*", but having different diameters (factor that changes). He strikes it, always with the same object and strength (factors that don't change) and observes the sound (factor that we are observing).

IMPORTANT: The experiment that the student suggests must be related to his initial hypothesis in order to be able to confirm or disprove it.
Examples of verifiable hypotheses supplied by 8 or 9 year old students.
I think that big things make low sounds.
I think it because the music teacher's big drum has a low sound.
I think that small metal sounds higher.
I think it because the little triangle makes a little sound and the big one, a big sound.
I think that metal sounds higher than wood.
I think it because the metal bell hurts my ears.

VARIABLE: A parameter that I can measure.

In science, there are 3 types.

Types of variables	**Definition**	**Examples related to the task**
DEPENDENT	Factor that changes and that depends on other established factors.	We want to qualitatively measure the frequency of the sound (high or low)
INDEPENDENT	Factor that we vary.	Here is a list of elements that may become independent variables or constants. • Materials • Length • Thickness • Diameter • Quantity of material used • Type of objects • Force applied • …
CONSTANT	Factor that must stay the same every time.	

The terms above are used in high school. With primary school students, it is preferable to stay with the definitions. Broach the notion of "FACTORS TO CONTROL" when they carry out their experiments.

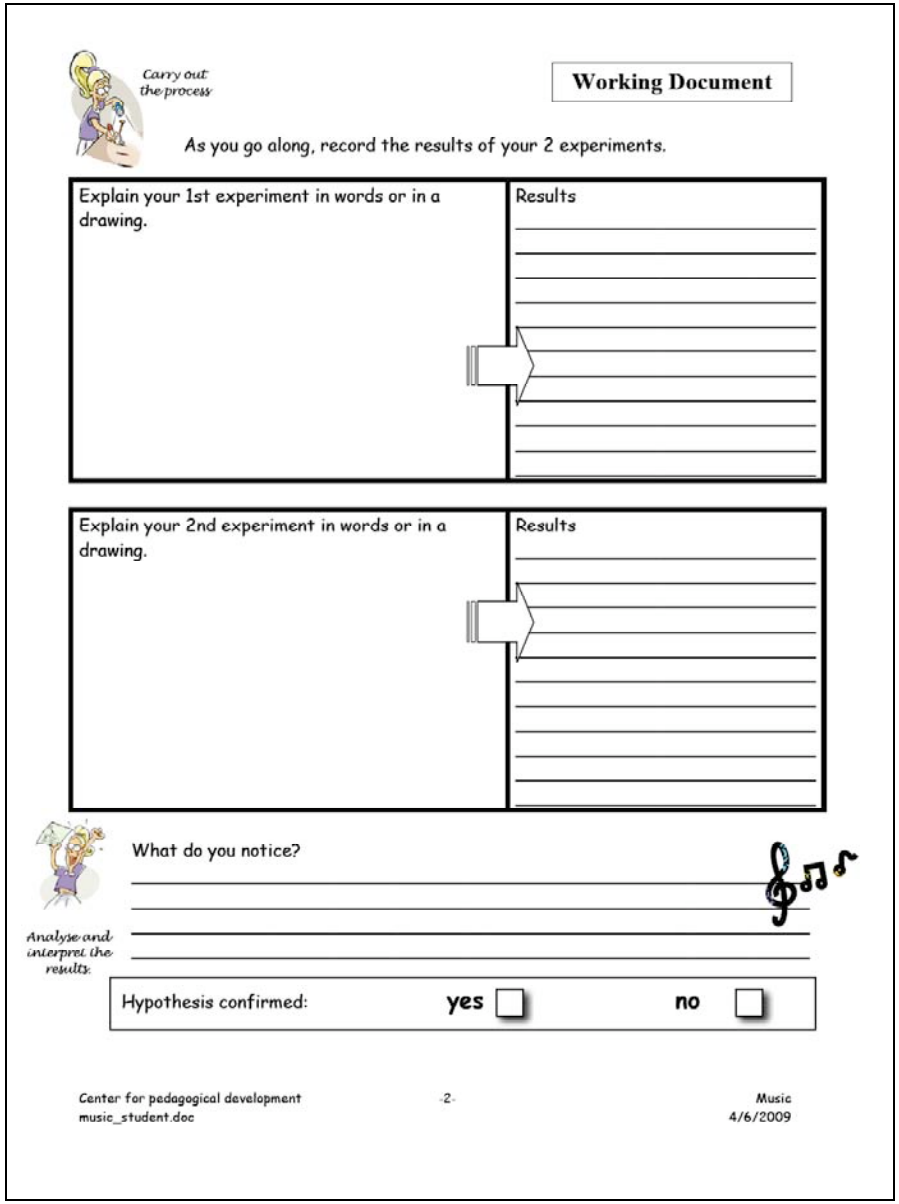
REALISATION
Activity 3
Objective: Planning the experiments

Suggested materials

- **Student booklet, p. 2**
- **Three different lengths of the same diameter of a given material (ABS, metal, stiff cardboard, wood, ...)**
- **Tubes of various materials, all the same length, but with different diameters**
- **Several glasses of the same size**
- **Pine mouldings of the same type but of different lengths**
- **Pine mouldings of the same length but different thicknesses**
- **Three different size tin cans**
- **Balloons**
- **Strips of plastic (ruler) the same length as the metal ones**
- **Strips of metal the same length as the plastic ones**
- **Wooden dowels of different lengths and diameters**
- **Wooden dowels of the same lengths but different diameters**
- **Plastic bowls of different sizes**
- **Metal bowls of different sizes**
- **Cardboard boxes of different shapes**
- **Plastic bottles of different sizes**
- **Marbles, macaroni**
- **Nails and bolts of different sizes**
- **Elastic bands**

Any other materials that allow the students to experiment with different sounds.

Duration: 20 minutes



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The teacher now invites the students to plan the experiments they want to carry out to demonstrate their preliminary explanations.

The students must also plan the materials they will need: what is available at school and what they will need to bring from home.

The students describe their 2 planned experiments.

IMPORTANT:
Always base the process on the notion we want to study: variables.

Activity 4
Objective: Carrying out the process

Material:
Student booklet, p.2

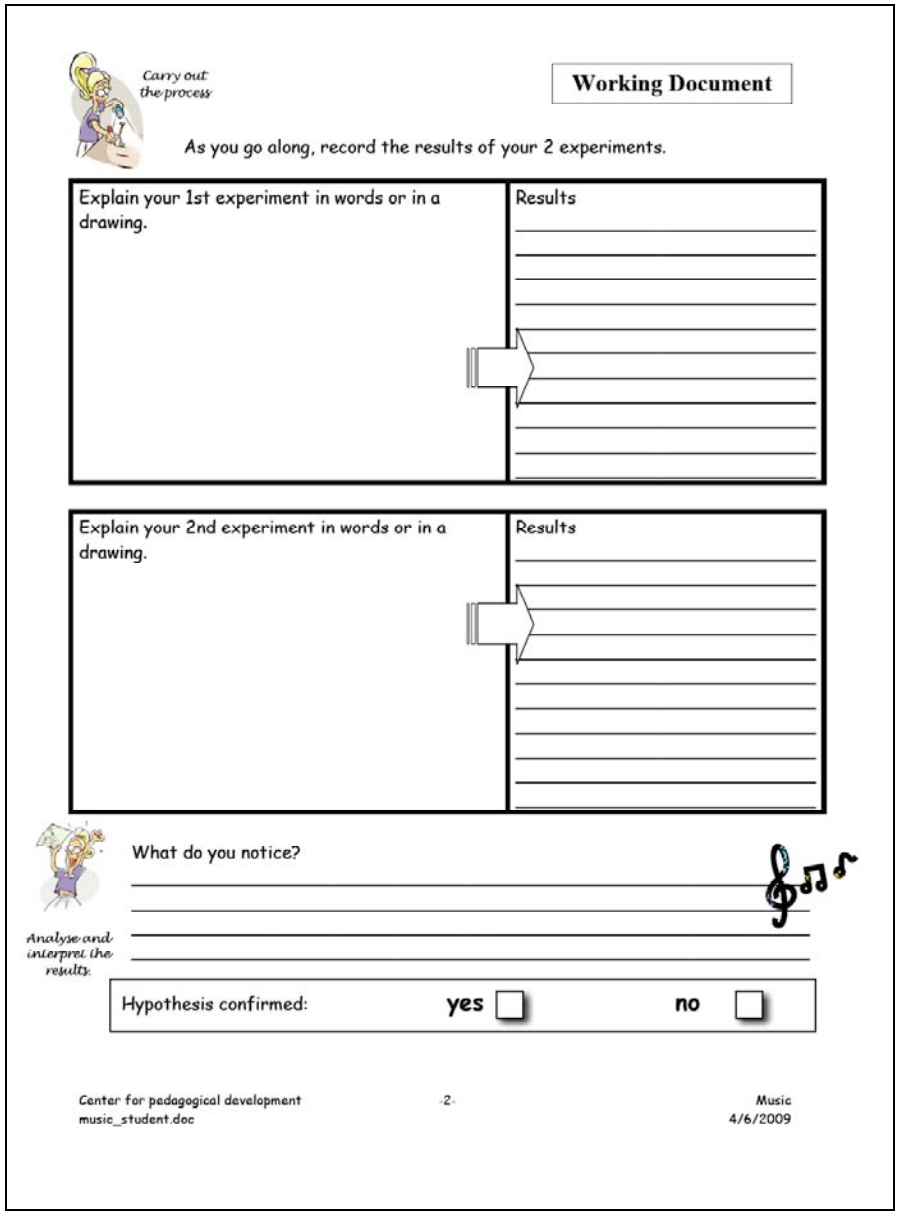
Duration: 30 minutes

Warning: This stage of the learning situation will be very noisy. You may choose a more isolated classroom (gym or music class) or make the most of a more appropriate time, for instance when the neighboring classes are in another room.

The students carry out their experiments and record what they notice. Throughout the activity, the teacher circulates and helps out those who are having a harder time with their explanations.

Examples of explanations from 9 year old students
I got a high sound from the metal and a low sound from the wood.
The fat plastic tube made a lower sound than the thin one.
The big balloon filled with macaroni sounds higher than the little one.
The plastic bottle sounds low and the glass one, high.
Marbles in a bottle sound higher than pieces of wood.

NOTE: It may be interesting to use a sound meter to measure the decibel level in class and to deal with the dangerous effects of sound on hearing.


Carry out the process

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As you go along, record the results of your 2 experiments.

Explain your 1st experiment in words or in a drawing.	Results

Explain your 2nd experiment in words or in a drawing.	Results

Analyse and interpret the results

What do you notice?

Hypothesis confirmed: yes ☐ no ☐

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Activity 5
Objective: Analysis and interpretation of the results

Material
Student booklet, p.2

Duration: 20 minutes

When the students have finished with their experiments, they will be invited to write a short conclusion in relation to what they noticed.

Examples of conclusions

Everything that was big sounded low, and the wood did too.
Metal and small pieces sound higher than plastic and the bigger things.
The bigger it is or if it's made of plastic, it sounds lower.

In large groups, the teacher reviews, establishing the factors that influence sound:

- Force applied,
- Materials,
- Dimensions,
- Forms
- …

The student is invited to confirm or disprove his hypothesis. The students may come up with new questions.

PREPARATION
Activity 6
Objective: Become familiar with the material and tools

Material:

- **Combined angle iron**
- **Ruler**
- **Mitre box**
- **Levelling saw**
- **Cordless screwdriver with chuck attached**
- **Hammer and nail**
- **Carpenter's glue**
- **Screwdriver**
- **Tin snips**
- **Clamps**

Duration: 15 to 20 minutes

When we begin an activity that requires the use of tools and instruments with which the students are not familiar, it is preferable to perform a demonstration. In addition, it would be a good opportunity to spend some time practicing with the tools, for safety and classroom management reasons.

1. Combined angle iron: The students may have a hard time placing it correctly on the piece of wood.

2. Ruler: The students generally know how to use a ruler.

3. Mitre box: A precise cut is ensured. It is important not to place the hands too close to the saw and to



Signs and pictograms concerning safety in the workshop are available on our website:
www2.cslaval.qc.ca/cdp/pages/documentation.html

carry out a horizontal back and forth motion. It is also possible to cut the pine moulding using only the saw.

4. Saw: Handle with care. A distracted or awkward use can cause cuts.

5. Drill: It may be easier to use a hand drill or an electric screwdriver. If a drill is used, ensure that students tie back long hair.

6. Hammer: Small size hammers are recommended. The children must be warned to hit only what they must.

7. Carpenter's glue: White school glue is sufficient and non-toxic.

8. Screwdriver: Be careful of moving around the class. The students must hold it safely.

9. Tin snips: It is preferable that an adult cuts the bobby pins, because it is quite difficult and the cut pieces may strike the eyes and cause serious injury.

Activity 7
Objective: Read the fabrication plan

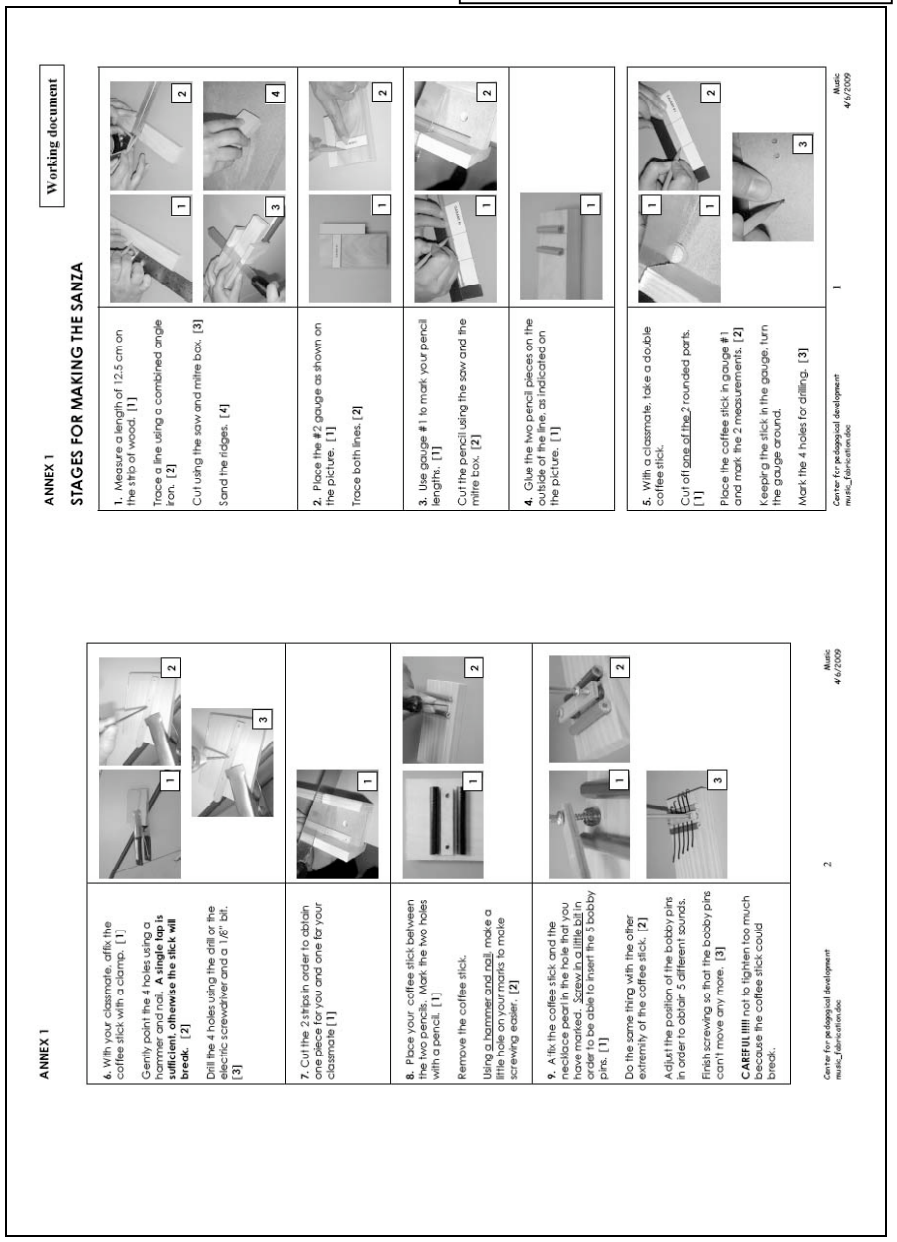
Material :

- **Fabrication plan**

Duration: 20 to 30 minutes

The teacher presents the fabrication plan and invites the students to read it in its entirety. The time devoted to this activity may more or less long to develop certain reading strategies.

NOTE: For stage #1 of the fabrication plan, the teacher may cut the mouldings to avoid the use of the saw.



Working document

ANNEX 1

STAGES FOR MAKING THE SANZA

1. Measure a length of 12.5 cm on the strip of wood. [1]
Trace a line using a combined angle iron. [2]
Cut using the saw and mitre box. [3]
Sand the ridges. [4]

2. Place the #2 gauge as shown on the picture. [1]
Trace both lines. [2]

3. Use gauge #1 to mark your pencil length. [1]
Cut the pencil using the saw and the mitre box. [2]

4. Glue the two pencil pieces on the outside of the line, as indicated on the picture. [1]

5. With a classmate, take a double coffee stick.
Cut off one of the 2 rounded parts. [1]
Place the coffee stick in gauge #1 and mark the 2 measurements. [2]
Keeping the stick in the gauge, turn the gauge around.
Mark the 4 holes for drilling. [3]

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ANNEX 1

6. With your classmate, affix the coffee stick with a clamp. [1]
Gently point the 4 holes using a hammer and nail. **A single tap is sufficient, otherwise the stick will break.** [2]
Drill the 4 holes using the drill or the electric screwdriver and a 1/16" bit. [3]

7. Cut the 2 strips in order to obtain one piece for you and one for your classmate [1]

8. Place your coffee stick between the two pencils. Mark the two holes with a pencil. [1]
Remove the coffee stick.
Using a hammer and nail, make a little hole on your marks to make screwing easier. [2]

9. Affix the coffee stick and the necklace pearl in the hole that you have marked. Screw in a little bit in order to be able to insert the 5 bobby pins. [1]
Do the same thing with the other extremity of the coffee stick. [2]
Adjust the position of the bobby pins in order to obtain 5 different sounds.
Finish screwing so that the bobby pins can't move any more. [3]
CAREFUL!!!! not to tighten too much because the coffee stick could break.

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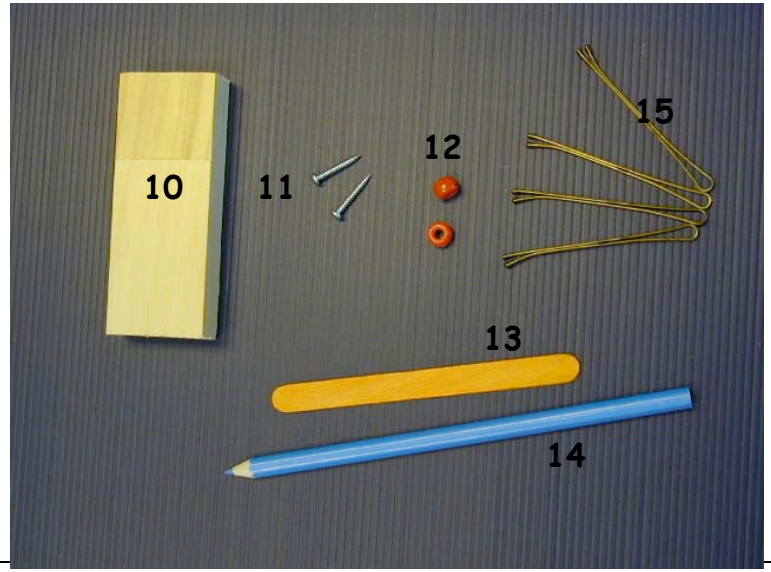
REALISATION
Activity 8
Objective: Making the instrument

Material for four work stations:
4 pencils
4 combined angle irons (1)
4 rulers (2)
4 mitre boxes (3)
4 gauge n° 1 (annex 1)
4 gauge n° 2 (annex 1)
4 levelling saws (4)
4 hand drills
or 4 electric screwdrivers with chucks added (5)
4 hammers et 4 nails (6)
Sand paper
Carpenter's glue (7)
4 screwdrivers (8)

Material for the class:
1 pair of tin snips (9)
2 pine mouldings of 2½ inches by 5/8 inches (10)

Per student:
2 ¾" square head #4 screws (11)
2 plastic necklace pearls (12)
2 popsicle sticks glued together (13)
1 pencil (or dowel) (14)
5 bobby pins, cut (15)





Duration:
Two 30 minute periods (with at least two hours between them to allow the carpenter's glue to dry).

The teacher may suggest to the students to cross out the completed stages on the plan in order to keep tabs on the work that has been completed. At evaluation time, the work will be easier. In the student booklet, the teacher will also find an observation schedule that he or she may record his or her observations as he/she goes along.

Suggestions:

- We suggest using pencils as opposed to dowels in order to reduce fabrication costs. Some children may object to sawing pencils. They should be told why that decision was made.
- Hot glue may seem faster to glue the necklace pearls, but we do not recommend it, because the children are not precise enough and risk blocking the hole. It is then very difficult or even impossible to screw through it.

- The children will need help with screwing because a fair amount of force is required.

- Allow for several additional Popsicle sticks because during drilling and screwing, many may crack or break.

Activity 9

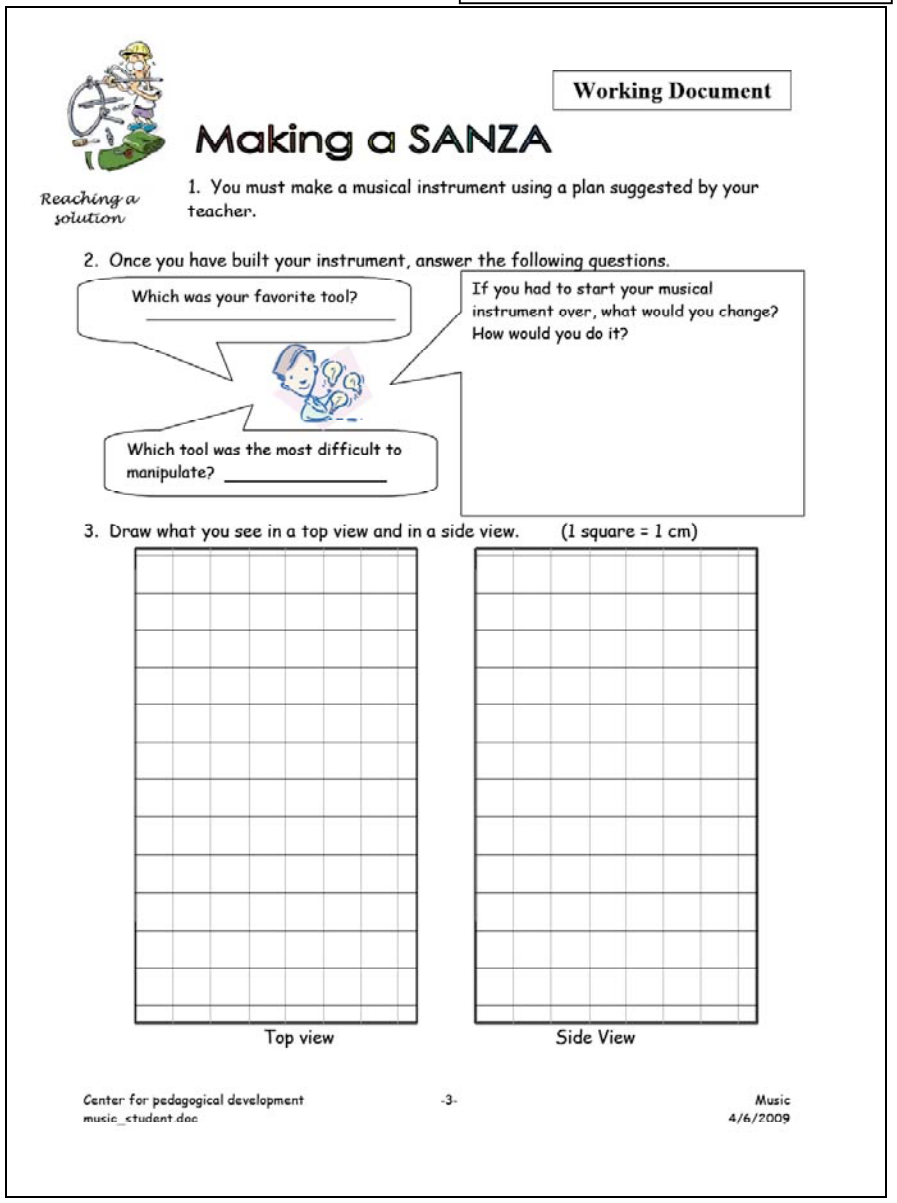
Objective: Auto evaluation and student reflection about his work making the instrument.

Material :
Student booklet p.3

Duration: 15 to 20 minutes

The teacher asks the students to trace two views of their instrument to show that the two sketches give different information regarding the same object. It is important to specify to the students what our expectations are:

Each part must be represented with a different colour;
The use of a ruler is mandatory;
The drawing must be tidy and the two views must be proportional.



Working Document

Reaching a solution

Making a SANZA

1. You must make a musical instrument using a plan suggested by your teacher.

2. Once you have built your instrument, answer the following questions.

Which was your favorite tool? _____

If you had to start your musical instrument over, what would you change? How would you do it?

Which tool was the most difficult to manipulate? _____

3. Draw what you see in a top view and in a side view. (1 square = 1 cm)

Top view

Side View

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INTEGRATION
Activity 10
Objective: Experiment with your instrument

Various materials:

- **4 plates of different materials: wood, plastics, foam carpet, glass, metal…**
- **Shoe boxes, metal containers, salad or other bowls…**
- **Student booklet p.4**

Duration: 30 minutes

The teacher leads the student to reflect upon the sound of the instrument that they have just made in order to eventually relate the scientific concepts associated to sound.



Carry out a trial run

Working Document

Experimentation with your instrument

1. Try to press with equal force on each note of your sanza. What do you notice about the tone of the different notes?

My observations

2. Choose a note and press softly. Listen. Take the same note again and press hard. Listen. What do you notice?

My observations

3. Take the instrument in your hands and play it. Listen to the tone. Place your instrument on the plates of different materials and listen. Play and listen. What do you notice?

My observations

4. Now place your instrument in the different containers put at your disposal. What do you notice? Record your observations.

My observations

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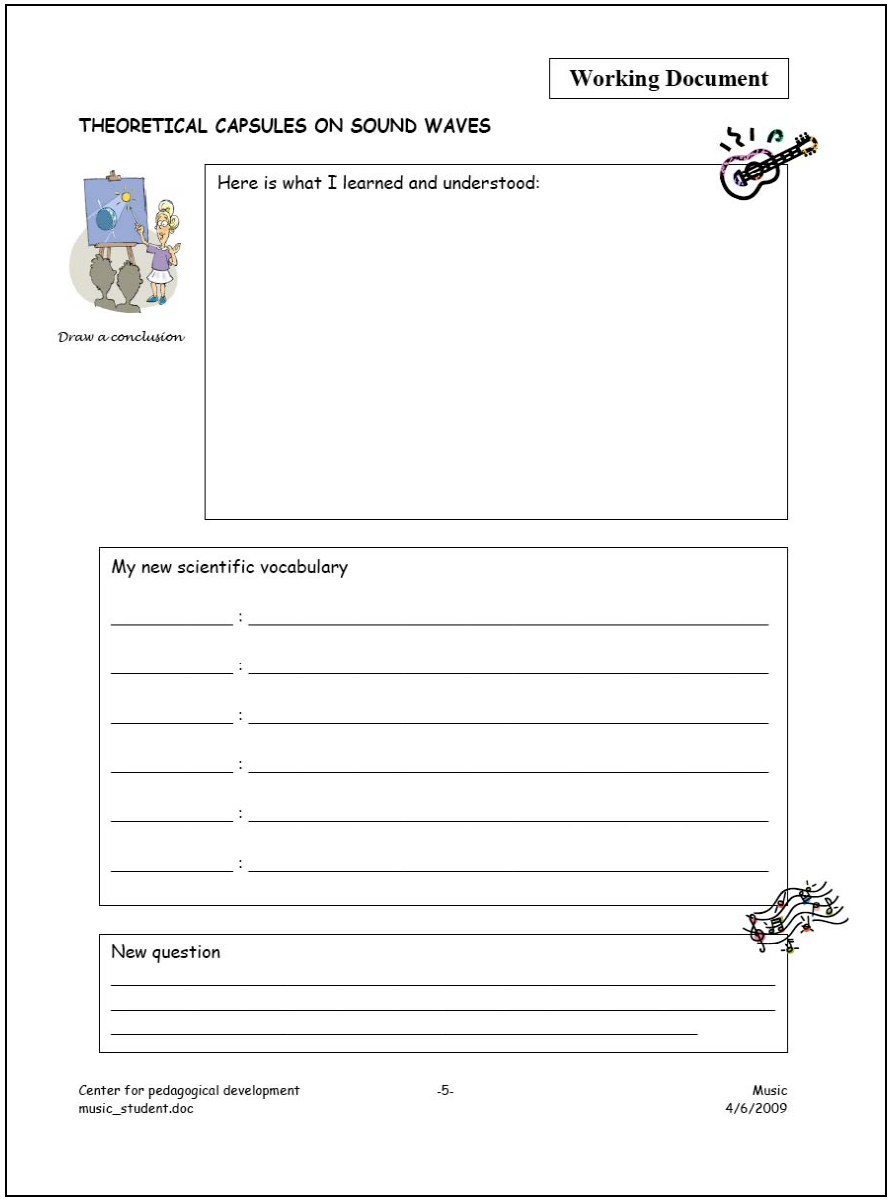
INTEGRATION
Activity 11
Objective: Demonstrate the propagation of sound wave through air.

Material
Video: «Sound» available at the following address: http://www2.cslaval.qc.ca/cdp/ under the "Documentation" tab
OR
Animation by the teacher using the materials described in the accompanying document entitled "Sound".
Student booklet: p.5
OR
Other documentation or demonstrations at your discretion.

Duration: 30 minutes

Using the accompanying document or the video, the teacher animates the capsule about the propagation of sound. The discussion then turns toward the formulation of a complete conclusion.

Finally, the students write, in their own words, the definitions of the scientific terms related to sound. The teacher helps the students, individually or as a group, so that they show a certain rigor in their work.



Working Document

THEORETICAL CAPSULES ON SOUND WAVES

Draw a conclusion

Here is what I learned and understood:

My new scientific vocabulary

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

_____ : _____

New question

_____

_____

_____

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