



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

Mechanical bugs



TEACHER'S GUIDE

November 2009

PREPARATION

Activity 1: Hunting for and observing arthropods

Objectives:

- *Observe arthropods (particularly insects);*
- *Identify the arthropods that they have found;*
- *Identify the external parts of their arthropods;*
- *Find and analyse interesting information about their arthropods.*

Equipment:

- Transparent containers for collecting (specific jars, medicine vials, plastic containers...)
- Gardening gloves, stir sticks or plastic spoons
- Re-sealable bags
- Magnifying glass
- Ruler
- Coloured pencils
- Observation sheet

Duration: 75 minutes

The students will carry out a bug collection around their school. Back in class, they will observe the specimens they have collected more closely. They draw and note their observations as to the animal's anatomy (colour, number of legs, particularities of the wings, texture, shell etc.). They also note the conditions in which they found their specimen (temperature, sun, habitat etc.).

We suggest that you use the observation sheet created by the Montreal Insectarium that you will find by following this link (In French only):

<http://www2.ville.montreal.qc.ca/insectarium/toile/nouveau/jeux/observ2.pdf>

MA COLLECTION

Dessine ce que tu observes.

Province: _____
Ville: _____
Date: _____
Observateur: _____

Nom du spécimen: _____

Habitat: _____
Heure: _____

Note tes observations: _____

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In order for the students to be able to identify their specimen, it is recommended you have various books about insects on hand.

During our experiment, we used the following two reference books, which aroused their curiosity:

Le livre qui fait BZZZ chez ERPI

http://erpi.com/documentaire/bzzz_p28341169.html

Les insectes du Québec de Yves Dubuc, Édition Broquet

http://broquet.qc.ca/livres_fiche.php?cat=3&id=60

A webography, as well as a more complete bibliography are suggested in the document called "theoretical capsule".

N.B. The observation of insects using a microscope (or a digital microscope) with Petri dishes is very stimulating for the students.

PREPARATION

Activity 2: Placing the scientific concepts

Objectives:

- *Identify the principal groups of arthropods (insect, arachnid, crustacean, myriapoda);*
- *Differentiate these arthropods by their number of legs;*
- *Know the principal parts of an insect (see theoretical capsule).*

Equipment:

- Equipment suggested in the documents from "La Maison Léon Provancher"
- Theoretical capsule
- Other resources (books, websites)

Duration: 60 minutes

The teacher animates a discussion whose objective is for the students to learn the difference between each group of arthropods (number of legs) and the principal parts of an insect.

Here are some questions and answers that may help guide the discussion:

- How could we classify the arthropods that we have collected?

Arthropods are invertebrate animals. They do not have a spine.

- Do they all have the same number of legs?

No. Arthropods that have six legs are insects. See the capsule for the other classes of arthropods.

- Among the insects you have gathered, into how many parts is the body divided?

All insects have bodies divided into three parts: head, thorax, abdomen.

- Among the insects you have gathered, how many wings does each one have?

Most adult insects have one or two pairs of wings but some have none at all.

We suggest that teachers use the documents produced by "la maison Léon Provancher". In them, you will find different activity suggestions with which to present the insect world to your students. Here are the links to access these PDF documents (in French only):

<http://www.maisonleonprovancher.com/documentspdf/entomologie.pdf>

<http://www.maisonleonprovancher.com/documentspdf/pdfintegration/insectes.pdf>

Another way to work on classification would be to ask the students to establish an identification key themselves. This way, they would have to suggest a solution to problem of a scientific nature. To facilitate this task, the bugs collected could be photographed. These photos could be used by several students at the same time (on screen or on paper) and for a longer time than living bugs. They might also be projected onto the wall.

REALISATION

Activity 3: Study of the connecting rod crankshaft mechanism

Objective: Observe and manipulate the connecting rod and crankshaft mechanism

Equipment

- 8 models of connecting rod and crankshafts, see the preparation guide for the necessary equipment
- See the equipment mentioned in the preparation guide
- 1 "jumbo" unbent paper clip per student (it is preferable that the paper clip be smooth, not striated)
- Labels to identify the work stations
- Student booklet, pages 1 to 3

Duration: 45 minutes

We suggest that the classroom be divided into different islands to create work stations. The students circulate from one station to the next. They will carry out the required operations and answer the questions on pages 1 and 2 of the student booklet.

By creating each work station twice, you can make 8 teams that work at each of the four stations. In this case, you will need to construct 16 models.

The drilling template (annex 1A) is used by the teacher. If you choose to have the students use it, it would be preferable to make several.

Once the work at the stations is done, the students indicate what the connecting rod and crankshaft are on the drawing.

Nom de l'élève : _____ Groupe : _____

Démarche de conception **Bibittes mécaniques** 


Identifier le problème

Ma conception:
Créer un insecte imaginaire et articulé, réalisé à partir de matériaux récupérés.


Bien cerner le problème

CAHIER DES CHARGES

L'insecte devra :

- être fabriqué à partir d'un des contenants mis à ta disposition;
- être muni d'un mécanisme de bielle et manivelle (vilebrequin);
- posséder les caractéristiques que tu auras dessinées (antenne ou non, ailé ou non, etc.);
- être réalisé à partir du matériel et des matériaux mis à ta disposition.

Étude du mécanisme bielle et vilebrequin 
Myoter ses idées

Qu'est-ce qu'une bielle? Qu'est-ce qu'un vilebrequin?

Poste 1: Pose les boîtes sur le bureau de manière à ne pas voir le mécanisme. Fais tourner le vilebrequin pour les boîtes de lait A, B et C. Pour chacune des situations, écris la lettre du contenant correspondant et explique ce qui se passe.

| Berlingot | Que se passe-t-il? | Explication |
|--------------------------|--|-------------|
| <input type="checkbox"/> | Le vilebrequin frotte sur le bureau. | _____ |
| <input type="checkbox"/> | Le vilebrequin frotte dans le contenant de lait. | _____ |
| <input type="checkbox"/> | Le vilebrequin tourne facilement. | _____ |

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Next, the teacher carries out a review of the studied mechanism. The texts in the table on page 3 are completed using the suggested words.

Here are the facts that the student must assimilate:

- The holes for the crankshaft axis must be made at a height which will not prevent its rotation.
- The hole to guide the connecting rod must be big enough to allow movement in the rod. The hole may be made bigger or smaller if the student errs.
- The connecting rod must be long enough so that it doesn't come out of the hole that guides it and to avoid that the animated part of the body does not block rotation.

N.B. The student booklet is divided into two parts. The first contains pages 1 to 3 and page 6, while the second includes pages 4 and 5. This way, the booklets may vary if you want to offer a choice of two containers to the students. In addition, the fronts and backs of each sheet are used.

Poste 2: Fais tourner le vilebrequin et observe la paille (bielle). Que se passe-t-il? Explique.

| Berlingot | Que se passe-t-il? | Explication |
|-----------|--------------------|-------------|
| D | _____ | _____ |
| | _____ | _____ |
| | _____ | _____ |
| E | _____ | _____ |
| | _____ | _____ |
| | _____ | _____ |

Poste 3: Fais tourner le vilebrequin et observe la paille. Quelle(s) partie(s) du corps pourrais-tu faire bouger dans chaque cas?

| Berlingot | Quelles parties pourraient bouger? | | | |
|-----------|------------------------------------|------|--------|------|
| F | antennes | tête | ailles | dard |
| G | antennes | tête | ailles | dard |
| H | antennes | tête | ailles | dard |

Poste 4: Pour fabriquer ton vilebrequin, suis les étapes décrites sur la fiche "Technique de pliage du vilebrequin".



INTEGRATION

Activity 4: Design, study and fabrication of the imaginary insect.

Objective: Reinvest the knowledge acquired in activity 3

Equipment:

- Student booklet, pages 4 and 5

Materials:

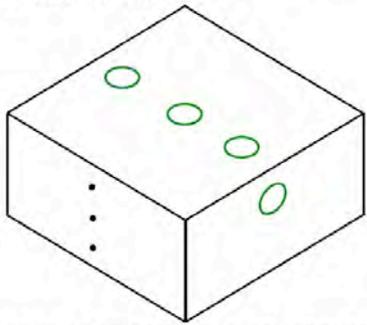
- 1 milk carton or other plastic or cardboard container, per student
- Crankshaft manufactured in activity 3 for each student
- Styrofoam balls
- Pompoms
- Pipe cleaners
- Cotton swabs
- Various coloured feathers
- Plastic stick-on eyes
- Decorative glass lozenges
- Plastic caps
- Corks
- Tissue paper
- Felt
- Construction paper
- Stick or white glue
- Finishing nails
- Hammer
- Punch
- Hole puncher
- Hot glue gun
- Scissors
- Annex 3: Drilling technique posters
- ...

Document de travail



COMMENT SERA MON INSECTE ?

Observe bien le schéma du berlingot. Suis bien chacune des étapes en cochant lorsque tu les auras terminées.



- Utilise un crayon rouge pour encercler l'endroit où tu feras tes trous pour insérer le vilebrequin.
- Quelle partie de l'insecte feras-tu bouger? Encerle ton choix : la tête, les ailes, les antennes ou le dard.
- Utilise un crayon bleu pour encercler l'endroit où tu feras l'ouverture pour la bielle (paille) qui fera bouger la partie mobile de ton insecte.
- Fais approuver tes choix par ton enseignante ou enseignant avant de passer à la fabrication.
- À l'aide d'un clou, tu dois maintenant faire les trous pour insérer le vilebrequin. Avec un crayon, marque l'endroit avant de percer.
- Tu dois ensuite faire l'ouverture pour la bielle. Utilise la pointe de tes ciseaux pour faire un trou et ensuite agrandis l'ouverture avec les ciseaux.
- Fais un trou, avec le clou et le marteau, dans la paille qui servira de bielle.
- Insère la bielle dans le vilebrequin.
- Insère le vilebrequin à l'intérieur du berlingot.

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Duration: 90 minutes or more

First, the teacher presents the students with the materials at their disposal. (S)he makes the most of the occasion to carry out demonstrations of some simple techniques. (See annex 3).

Next, the students think about their insect by answering the questions on pages 4 and 5 of their booklet. They make the insect simultaneously. Using the materials they have chosen, they draw their idea.

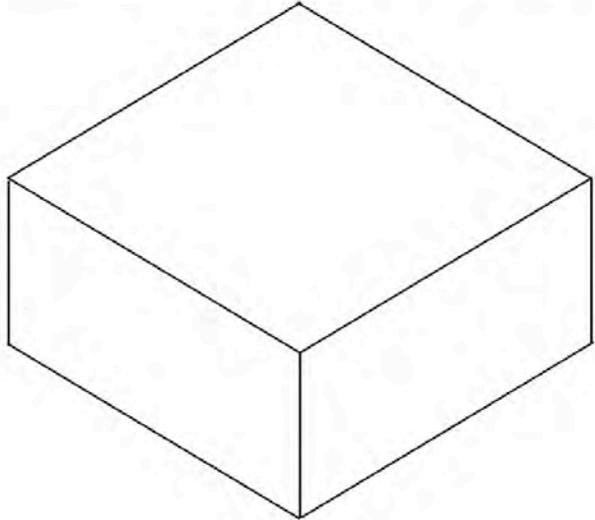
One of the difficulties that may be encountered is to have made the hole too small or too big, which would impede the correct function of the mechanism.

If the hole is too small, they need only make it bigger for the mechanism to work correctly. If it is too big, they need only add a piece of cardboard, wood or coffee stick to make it smaller.

Document de travail

Tu peux maintenant décorer ton berlingot pour lui donner l'aspect d'un insecte imaginaire.

- Dessine le trou et la bielle (paille) sur le schéma de contenant ci-dessous.



- Dessine, sur ta bielle, ce qui bougera (la tête, les ailes, les antennes ou le dard).
- Dessine, sur le contenant, ce qui ne bougera pas (pattes, ailes ou tête, antennes, yeux, bouche).

Maintenant que tu as terminé, indique les matériaux que tu as utilisés pour chacune des parties du corps de ton insecte.

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INTEGRATION

Activity 5: Test their insect's function

Objective: *Test, evaluate and improve upon the mechanism for their insect.*

Equipment:

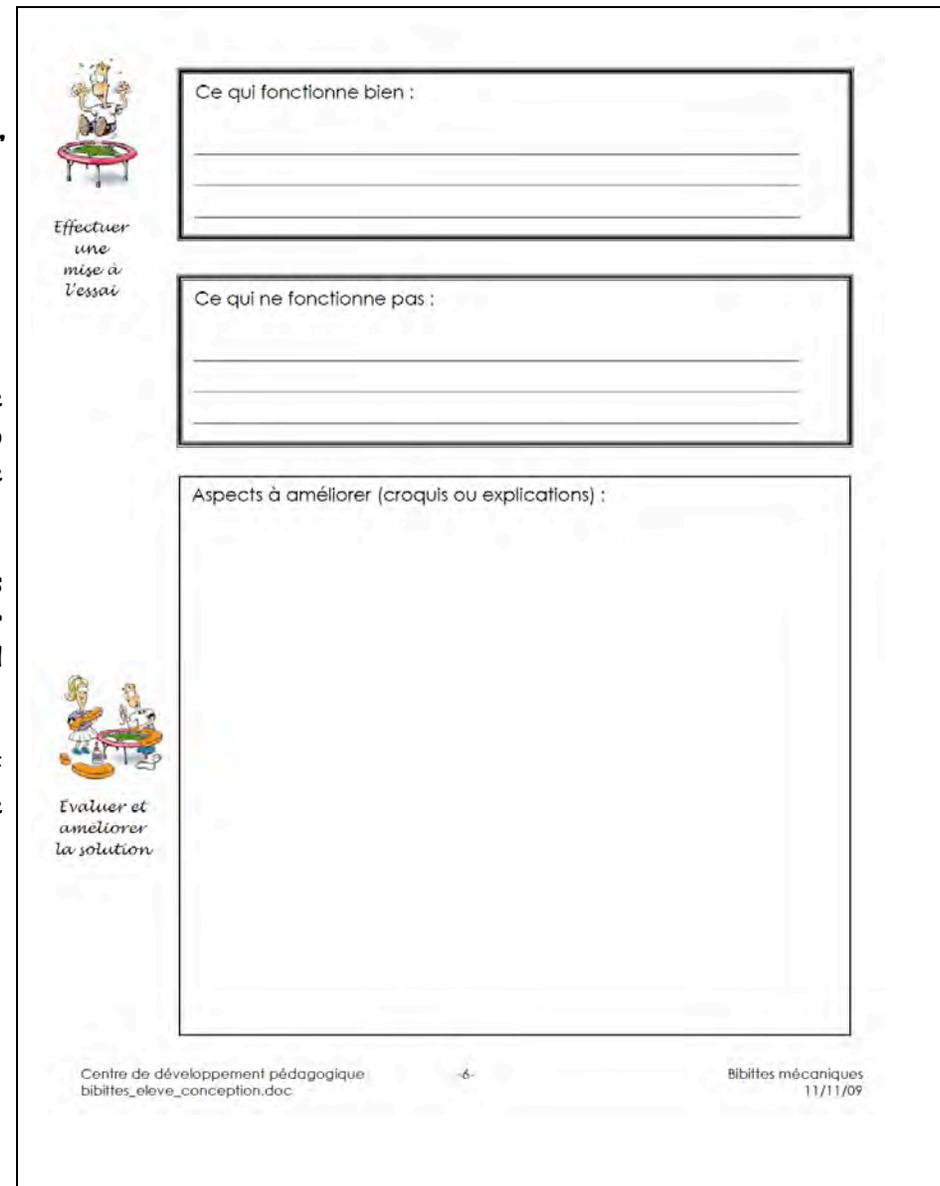
- Student booklet, page 6
- Imaginary mechanical insect

The students carry out tests of their mechanism. They complete page 6 by noting what worked well and what did not work. They also note, in the form of a sketch or explanations, the improvements to be made to their insect.

A review with the whole class is made concerning the improvements made to the prototypes. The students can present their improvements orally. The teacher may then evaluate the third disciplinary competency (understanding and transmitting information).

After that, the prototypes can be exhibited at the front of classroom. A discussion follows in order to determine if the mechanical bugs are insects:

- a three part body;
- the presence of antennae or not;
- legs and wings attached to the thorax;
- six legs.




Effectuer une mise à l'essai

Ce qui fonctionne bien :

Ce qui ne fonctionne pas :

Aspects à améliorer (croquis ou explications) :


Evaluer et améliorer la solution

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Evaluation trails

The teacher can make a mechanical bug that doesn't work. The student must observe it and determine what does not work. In a short written text, he must also identify what needs to be modified in order for it to function (evaluation of the first and third disciplinary competencies).

By letting the students themselves find the identification key, the teacher can evaluate the first disciplinary competency.

The diagram carried out on page 5 of the student booklet could evaluate the third disciplinary competency.

A comparison of the preliminary drawing (student booklet, page 5) with the prototype would allow you to evaluate the second disciplinary competency. By observation, the teacher can evaluate whether or not the student followed the steps and used the templates adequately (second disciplinary competency).

To go a little further...

Following these activities, it would be possible to go further with the insect theme by integrating other subject matters.

In science and technology, you could work on the following essential knowledge (of the progression of his learning):

Transformation of living things

- Describe the growth stages of different animals.

To integrate the ICT into the project, it would be possible to do a research project on the bug that was captured and studied. The presentation of this research could be made in the form of information cards (classification of the insect, short description, habitat, ecological role, etc...).

During the experiment, one of the teachers noticed that the students spontaneously named their bugs. She therefore had the idea of having them write a story that recounted the adventures of their insect. It would also be possible to create an information card on the imaginary insect inventing an order, a habitat, an ecological role...

A census of the insects captured or seen while gathering could also be carried out. The students would work on collecting, describing and organising the data, using data tables. The results of the census could be presented in the form of diagrams.

