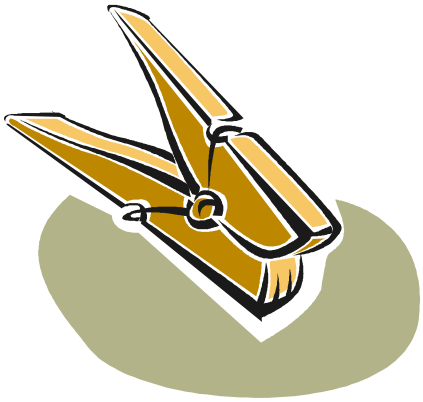
centre de développement pédagogique
pour la formation générale en science et technologie

Quite the pin!



GUIDE

CYCLE 1, 2 OR 3 of ELEMENTARY

Spring 2013

Once the LES has been tried, sample student answers will make this guide complete.

Thanks to :

For linguistic review, in French:

- Lucie Brouillette

For English translation :

- Christine Tansey

Note:
For the purposes of brevity, the masculine form has been used.

A quick glance at *Quite the pin!*

This LES was designed to support cycle 1, 2 and 3 teachers in the appropriation of the general learning process in science and technology in elementary school. This appropriation will occur while the task is carried out with the students. The theme broaches the process of learning the concepts common to the 1st, 2nd and 3rd cycles in the *Progression of Learning* within the framework of a complex task where the student will have to implement an experiment in the context of a technological analysis.

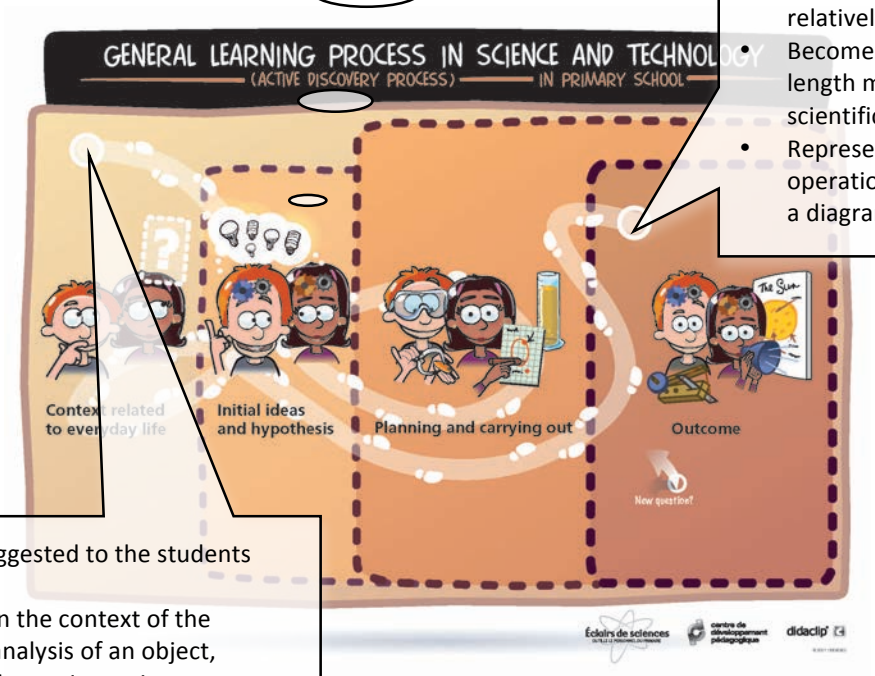
This task could also be used as an evaluation situation in science and technology.

As a learning activity:

- Technological analysis and sketching in elementary school

Main targeted learning (p. 4 to 6)

- Carry out the whole process relatively independently.
- Become familiar with length measurement in a scientific context.
- Represent an object and its operation using a sketch or a diagram.



Complex task suggested to the students

In the context of the analysis of an object, determine, using experimentation, the characteristics of a clothespin judged superior to another, and explain its operation.

Quite the pin!
Science and technology – 1st, 2nd or 3rd cycle
Overview

Pedagogical aims

This learning situation allows the student to experience the general learning process independently in science and technology in elementary school.

- It allows the student, whether or not they have experienced this process, to suggest a solution to a problem of a technological and scientific nature.
- It allows the student to work on the notion of measurement, putting forward strategies specific to science and technology.

Proposed context

Faced with the task of evaluating an everyday object, the student will have to discover one or more characteristics allowing him to judge the quality of this object. He will need to illustrate the object judged superior and explain its operation.

Broad area of learning

Orientation and entrepreneurship

- Grasping strategies related to a project: this learning situation takes place within the context of a comparative analysis of products. The student must deploy strategies related to various facts of the implementation of a project: (information, decision-making, planning and implementation).

Competencies

- To propose explanations for or solutions to scientific or technological problems
- To make the most of scientific and technological tools, objects and procedures
- To communicate in the languages used in science and technology

Statements from the *Progression of learning*

This activity is suggested for any of the cycles in elementary school as a learning and evaluation situation or as an evaluation situation. The statements in the *Progression of learning* therefore vary depending on the cycle. The statements are presented by cycle, one after the other. As the legend below indicates, the targeted statements for the 1st cycle are an opportunity for re investment in the following cycles.

As a complement to the statements below, a lexicon and complementary references have been added on pages 8 and 9.

Legend:

✶: Worked on during the LES
↻: Previous cycle(s)
+: Optional

Material World

1st cycle of elementary school

- ✶ A.1.a. Classifies objects according to their properties (e.g. colour, shape, size, texture, smell)
- ✶ C.6.a. Identifies situations involving the force of friction (pushing on an object, sliding an object, rolling an object)
- ✶ D.1.a. Describes the parts and mechanisms that make up an object
- ✶ D.1.b. Identifies the needs that an object was originally designed to meet
- ✶ F.1.a. Appropriately uses terminology related to the material world

2nd cycle of elementary school

- ↻ A.1.a. Classifies objects according to their properties (e.g. colour, shape, size, texture, smell)
- ✶ A.1.e. Describes the shape, colour and texture of an object or a substance
- ↻ C.6.a. Identifies situations involving the force of friction (pushing on an object, sliding an object, rolling an object)
- ✶ C.6.b. Describes the effects of a force on an object (e.g. Sets it in motion, changes its motion, stops it)
- ↻ D.1.a. Describes the parts and mechanisms that make up an object
- ↻ D.1.b. Identifies the needs that an object was originally designed to meet
- ✶ E.1.a. Appropriately uses simple measuring instruments (rulers, dropper, graduated cylinder, balance, thermometer, chronometer)
- ✶ F.1.a. Terminology related to an understanding of the material world
- ✶ F.2.a. Communicates using appropriate types of representations that reflect the rules and conventions of science and technology (e.g. symbols, graphs, tables, drawings, sketches, norms and standardization)

3rd cycle of elementary school

- ↻ A.1.a. Classifies objects according to their properties (e.g. colour, shape, size, texture, smell)
- ↻ A.1.e Describes the shape, colour and texture of an object or a substance
- ✶ A.1.j Describes various other physical properties of an object, a substance or a Material (e.g. elasticity, hardness, solubility)
- ↻ C.6.a Identifies situations involving the force of friction (pushing on an object, sliding an object, rolling an object)
- ↻ C.6.b. Describes the effects of a force on an object (e.g. Sets it in motion, changes its motion, stops it)
- ↻ D.1.a Describes the parts and mechanisms that make up an object
- ↻ D.1.b Identifies the needs that an object was originally designed to meet
- ✶ E.1.a. Appropriately uses simple measuring instruments (rulers, dropper, graduated cylinder, balance, thermometer, chronometer)
- ✶ F.1.a. Terminology related to an understanding of the material world
- ✶ F.2.a. Communicates using appropriate types of representations that reflect the rules and conventions of science and technology (e.g. symbols, graphs, tables, drawings, sketches, norms and standardization)

Strategies

Since this activity targets any of the cycles in elementary school, the accent is placed upon the general learning process in science and technology. The challenge presented is accessible to all and allows the student to experience the entire process independently. The activity also offers a pertinent context for implementing strategies specific to science and technology. It is preferable to plan feedback activities with the students, alone or as a group, to allow them to integrate these strategies. Depending on your situation, you may choose activities among the following:

- Exploration strategies
  - Distinguishing between the different types of information useful for solving the problem
  - Recalling similar problems that have already been solved
  - Drawing a diagram for the problem or illustrating it
  - Exploring various ways of solving the problem
  - Imagining solutions to a problem in light of his or her explanations
  - Using different types of reasoning (e.g. induction, deduction, inference, comparison, classification)
  - Using empirical approaches (e.g. trial and error, analysis, exploration using one's senses)
- Instrumentation strategies
  - Using technical design to illustrate a solution (e.g. diagrams, sketches, technical drawings).
  - Using different tools for recording information (e.g. diagrams, notes, graphs, procedures, logbook)
- Communications strategies
  - Using different means of communication to propose explanations or solutions (e.g. oral presentation, written presentation, procedure).
  - Organizing information for a presentation (e.g. tables, diagrams, and graphs).
  - Comparing different possible explanations for or solutions to a problem in order to assess them (e.g. full-group discussion)

Evaluation of learning

The evaluation criteria as well as elements promoting the understanding of the criteria related to the suggested activities are integrated into the student booklet. Since this is a task within a context, calling upon the production of a process, all the criteria may be used for feedback by the teacher.

When an activity presented in the booklet is very structured by the teacher (methods imposed), the criteria are presented in grey in the student booklet. This indicates that it is not recommended to evaluate the student on this element.

Interdisciplinary links

In mathematics

Measurement - Lengths: (Progression of Learning – Mathematics – Elementary school – Page 17)

A. Lengths	1	2	3	4	5	6
1. Compares lengths	→	★				
2. Constructs rulers	→	★				
3. Estimates and measures the dimensions of an object using unconventional units	→	★				
4. Estimates and measures the dimensions of an object using conventional units						
a. metre, decimetre and centimetre	→	★				
b. metre, decimetre, centimetre and millimetre			→	★		
c. metre, decimetre, centimetre, millimetre and kilometre					→	★

Quite the pin! – The vocabulary

1st, 2nd or 3rd cycle of elementary school

The Vocabulary of the *Progression of Learning*

Body
Force
Friction
Material
Measurement
Need
Object
Part
Property
Rule
Shape
Sketch
Symbols
Table(s)
Texture
Weight*

The vocabulary associated to the General Learning Process in science and technology

Analysis
Experiment
Observation
Result
Test

Complementary vocabulary

While this vocabulary is not the subject of formal evaluation, we recommend that it be presented to the students.

Wood
Lever
Link
Metal
Plastic
Spring
Performance test

* The word “weight” has several meanings and is used to designate very different elements. For example, in the Antidote RX, V8 software dictionary, there are 9 different definitions

- In science, weight is a force. It is the force exerted on an object or body when it is subjected to gravity.
- In the expression “add weight” it is understood that mass is added and that this mass increases the force exerted, and thus, the weight.
- Weight and mass are often confused. These two terms are related, but designate two different things. Mass is the quantity of matter contained in an object. For example, the mass of a person is the same on Earth or on the Moon, but the weight is less on the Moon, since its gravity is lower.

Complementary references

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General learning process in science and technology in elementary school
http://www2.cslaval.qc.ca/cdp/UserFiles/File/previews/general_process/

Vignettes (illustrations)
http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/clipart_science_technology/

Theoretical capsule on technological analysis and technical language (in French)
http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/analyse_primaire.pdf

Introductory document to technological analysis: why analyse objects and the borders of analysis.
http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/analysis.pdf

Inventions et découvertes du XV^{e} siècle — Le Faiseur de Ripailles

Invention du ressort : 1490
http://www.lefaiseurderipailles.fr/pages/technologies-et-decouvertes-au-moyenage/inventions-et-decouvertes-du-moyen-age/inventions-et-decouvertes-du-xv-siecle.html

Échos de mon grenier

Site qui présente l'histoire la plus complète de l'épingle à linge
http://echos-de-mon-grenier.blogspot.ca/2012/06/la-pince-linge.html

Description of the learning situation

Preparation phase	**Pages in the student booklet**
• Context related to everyday life • Initial ideas	Page 1 Page 2
Performance phase	
• First explanation (Hypothesis) • Planning (Materials and protocol) • Implementation (Results) • Report (Readjustments)	Page 2 Page 3 Page 4 Page 5 (amendment to the initial process)
Integration phase	
• Report (Review of initial ideas and the hypothesis, unforeseen events or problems encountered) • Acquired knowledge	Page 5 Page 6
Learning activities* (to be carried out when deemed appropriate)	**Optional**
• Sketching • Technological analysis in elementary school • New words	

* Certain learning activities may be found in the “Documentation” section on the CDP web site.

Animation guide

Important!

The following pages are related to the student booklet. In them, you will find proposals for animating the learning situation.

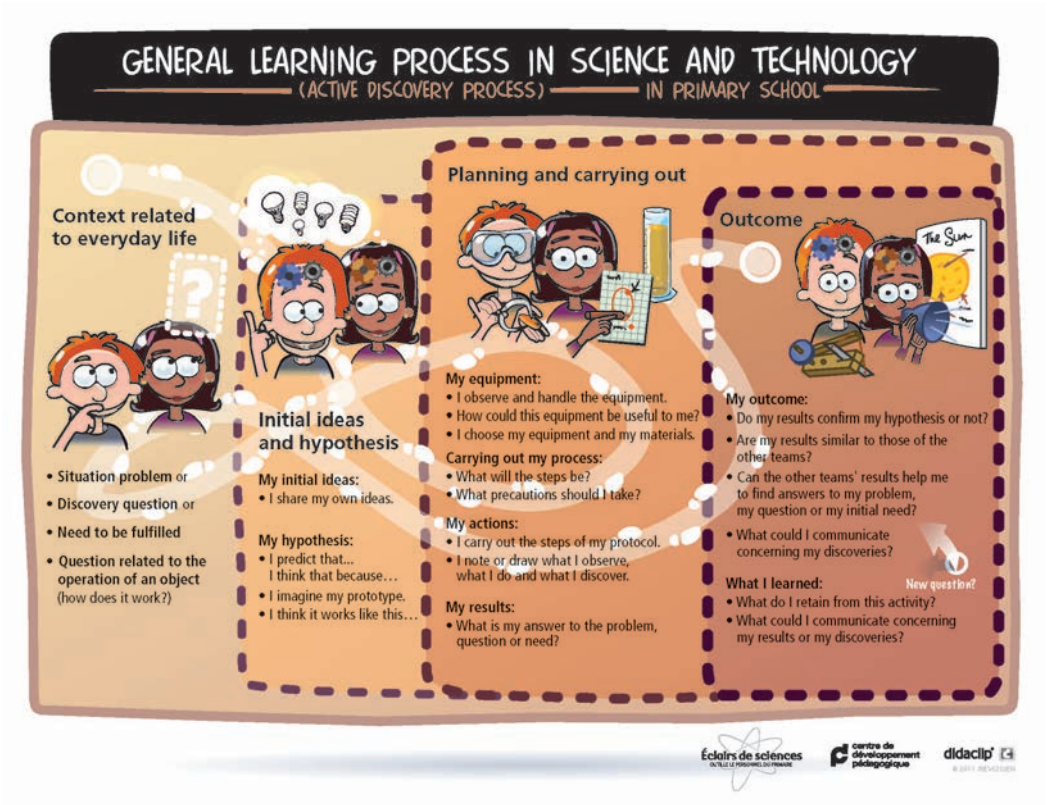
For the "*Quite the pin"* activity, there are three version of the student booklet:

- A "cycle one of elementary school" booklet with handwriting practice lines;
- A "cycle one of elementary school" booklet without handwriting practice lines, for grade 2;
- A "cycles two and three of elementary school" booklet.

To respond to the adapted pedagogical aim, one or other of the booklet models may be used, depending on the targeted class, the timing in the cycle and on the experience (or autonomy) of the students. The use of the open booklet in the cycles two and three is the ideal to be reached, but the teacher must organise the teaching plan so as to allow the student to achieve at least a certain degree of autonomy.

We have produced a single pedagogical guide to avoid duplicating documents. While what we suggest is for the students to experience a learning situation in science and technology, the following pages suggest animations the teacher may adapt to suit the situation.

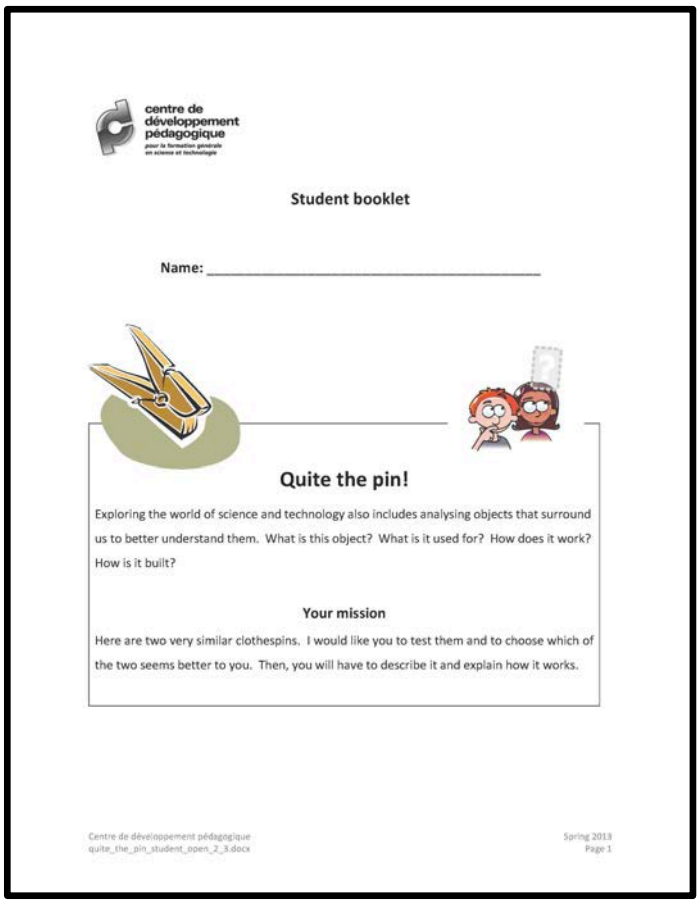
The proposed animation may seem linear. Much as scientists and technologists do, however, it is possible and even recommended to allow the students to go back over certain elements in order to readjust them. The only elements we ask the students not to modify are their initial ideas and hypotheses.



Preparation phase

Context related to everyday life

Estimated time: 15 to 30 minutes



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Student booklet

Name: _____

Quite the pin!

Exploring the world of science and technology also includes analysing objects that surround us to better understand them. What is this object? What is it used for? How does it work? How is it built?

Your mission

Here are two very similar clothespins. I would like you to test them and to choose which of the two seems better to you. Then, you will have to describe it and explain how it works.

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quite_the_pin_student_open_2_3.docx

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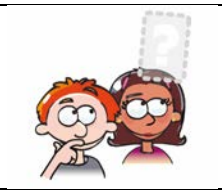
Page 1

1. Read the task: trigger and mission. Ensure proper understanding.

- It may be useful to highlight the key words and new words. Then the students can circle them.
- In a group discussion, it will be necessary to agree on a common definition for the words “analysis” and “test”.
- If this is the student’s first contact with a complex task and with the general learning process in science and technology, the simplified poster and the booklet pertaining to the general process should be presented.



Preparation phase

Context related to everyday life

Estimated time: 15 to 30 minutes

Initial ideas

First, here are two different clothespins.

What is this object used for?

How does it work?

Your hypothesis:

In your opinion, which is the better clothespin?

Cr1 Appropriate description of the problem	Formulation of a tentative or explanation or solution	

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Page 2

1. Ask that the students propose an initial explanation

- It is recommended that you encourage the students to manipulate the materials. Two models of clothespins should be available so that students can adequately describe the problem and pose their hypothesis.
- You must ensure that the word "hypothesis" is understood both by novices and by more experienced students. An association may be made by analogy reminding students how we make hypotheses (anticipation) while reading.
- While on the subject of hypotheses, it is important to underline to the students that at this stage it isn't important to have the "right answer". It is the justification that matters.
- The use of a pen is recommended for this part of the task.
- In the justification section, the "I think that" is important to complete, but may be a significant challenge for some students, particularly younger ones. Here are some suggestions for strategies to put into place:
    - Do the "I think that" section orally.
    - Ask the students to relate a personal experience.

2. What about the initial ideas?

This task is feasible for all students and presents a problem which consists in observing two similar objects which respond to the same need. The student will have to notice the differences which, in his opinion, could influence the use or performance of the objects. The initial ideas, associated to function, will almost always be related to the first explanation (hypothesis). In this case, distinguishing between the initial ideas and the hypothesis becomes superfluous.

3. Concerning the need to which the object responds

Humans design objects to respond to needs. When the question "What is this object used for?" is asked, we could also ask "to what need does this object respond?" Later (in high school) the student will be asked "What is the object's overall function?"

Preparation phase and beginning the performance phase

Initial ideas and hypothesis

Estimated time: 15 minutes

1. Make teams of two (2) students

The students can carry out the experiments in pairs. Each student will have to fill out his booklet individually.

2. Presenting the materials[1]

The students may use all the materials presented in class, but some elements may not be useful to them. Depending on the chosen performance test, they may, with the agreement of the teacher, add materials. For student in the 1st cycle, or in order to differentiate, a materials list is supplied in an appendix (page 20) in order to simplify the representation (diagram or sketch) of the test.

It is recommended that the term "sketch" be explained, namely a quick sketch of what they intend to do.

3. The ruler

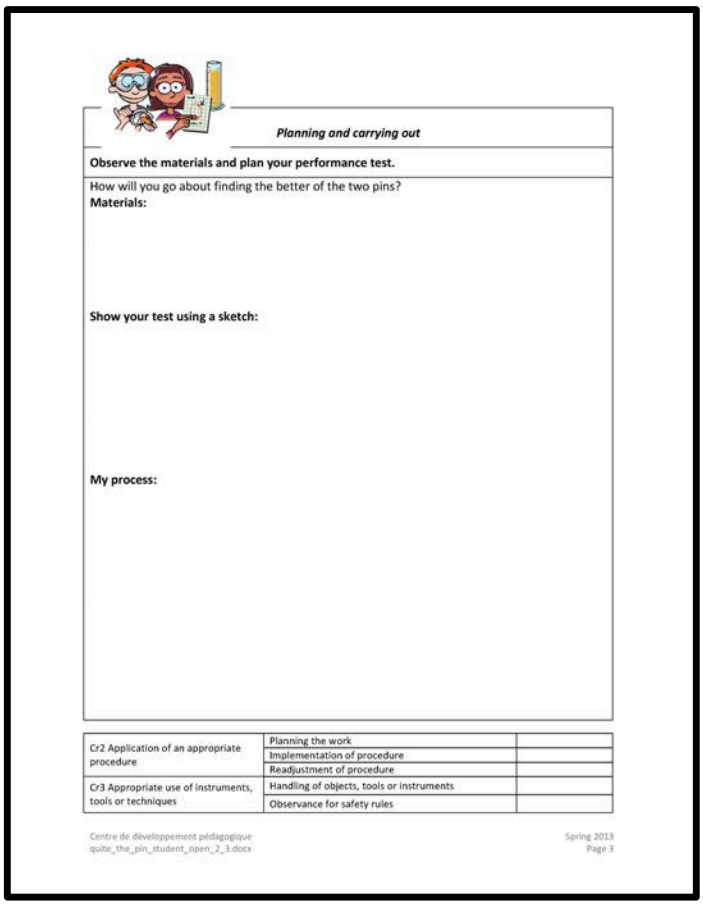
Ideally, for the students who are experiencing their first use of a ruler, a learning activity should be planned. It is also possible to invent a test so that the use of conventional measurement units becomes unnecessary.

[1] For complementary information on all the items, please refer to the *Proposals for materials* at the end of the guide.

Performance phase (continued)

Planning and carrying out – The process

Estimated time: 30 minutes



Planning and carrying out

Observe the materials and plan your performance test.

How will you go about finding the better of the two pins?
Materials:

Show your test using a sketch:

My process:

Cr2 Application of an appropriate procedure	Planning the work	
	Implementation of procedure	
	Readjustment of procedure	
Cr3 Appropriate use of instruments, tools or techniques	Handling of objects, tools or instruments	
	Observance for safety rules	

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Page 3

1. Implementation with the whole class

The testing process can be done in a group environment with the whole class. If this is how the teacher wishes to proceed, the teacher will need to complete the test on the board, ensuring that everyone understands the steps to follow.

2. Carrying out in pairs (LES or ES)

If the students work in pairs for the performance test and for testing, it will be necessary to ensure that each student consign his traces individually. It will also be necessary to supervise those who have special needs (reading, motor skills, etc.)

To lead the students in planning their process, it is important present the available materials. It is recommended that the students who wish to do so have the opportunity to manipulate the materials.

3. Consigning the traces

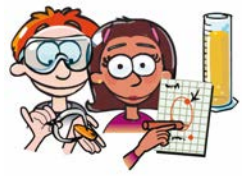
It is important to note that the student booklet allows the student to leave traces of his ideas, his process, his results and the answer in response to the problem presented. The understanding of the problem may be shown by drawings, sketches or words. A balance must be reached between the time required to resolve the problem and the time necessary to document it.

4. Adjustments during the experiment

Adjustments during experiments are frequent. There may be details unforeseen at the start or major revisions to the initial plan. A quick and simple way to keep track of these adjustments is to encourage the use of a different colour pencil to annotate the sketch or the process.

5. About the accuracy of the test

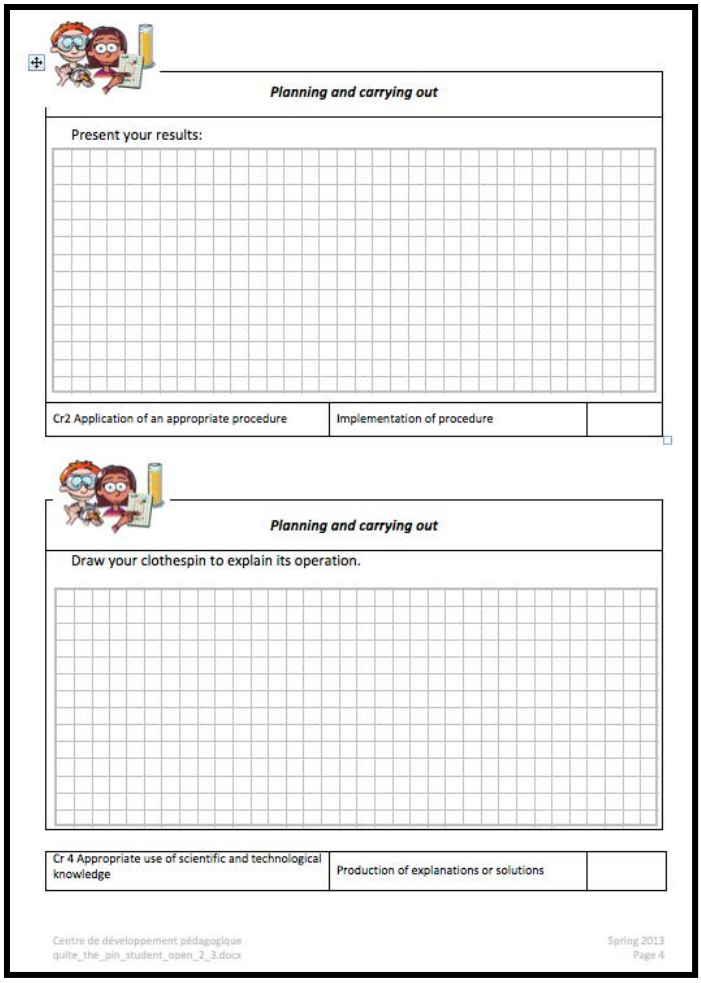
The notion of the accuracy of the test may be broached with more autonomous students (end of 2nd cycle and 3rd cycle). It refers to the repetition of similar results under the same test conditions. It confers great importance to the invented test. Conversely if the results are random for each test, it will be difficult to confirm or refute the hypothesis.



Performance phase (continued)

Planning and carrying out — Results and explanation of operation

Estimated time: 20 minutes (the results are noted at the same time as the test – the time allocated to the representation)



Planning and carrying out

Present your results:

Cr2 Application of an appropriate procedure	Implementation of procedure	

Planning and carrying out

Draw your clothespin to explain its operation.

Cr 4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions	

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Page 4

1. Consigning the results

It is the student's responsibility to note the results of his test by choosing the most appropriate consignment method to his data collection or to his observations.

Some students will choose to glue a strip of paper or adhesive tape consigning the position of the clothespins, how far the elastic stretches or a trace related to the invented test. Other students will choose a data table or a sketch to consign their results.

2. Illustration of the clothespin and explanation of its operation

If the students are autonomous and resourceful, it would be suitable for them to represent the pin and its operation their own way. You may insist on the use of distinct colours for each of the parts and arrows to indicate the movement.

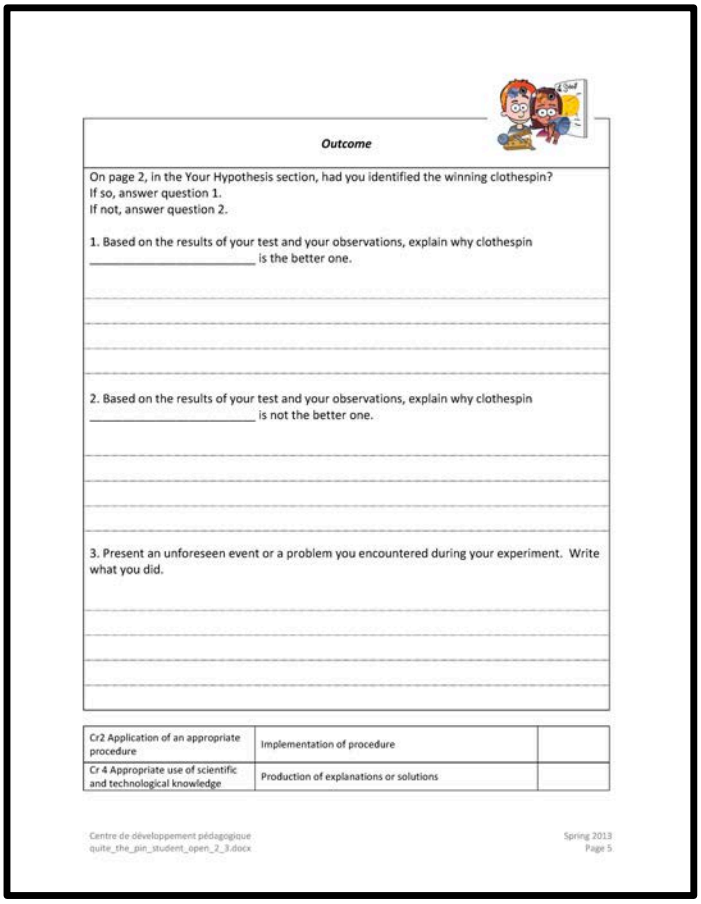
It is possible, however, to plan a time for familiarising the students with sketching related to technological analysis. In the references on page 8, you will find a theoretical capsule about analysis intended for elementary school teachers.

If time is lacking or if the students are unable to come up with realistic plans, you may use the annex (page 23) where each of the levers of the clothespin and its spring are shown.

Performance phase (end) and integration phase

Report

Estimated time: 20 to 30 minutes, or more if you want all the students to have the opportunity to express themselves.



Outcome

On page 2, in the Your Hypothesis section, had you identified the winning clothespin?
If so, answer question 1.
If not, answer question 2.

1. Based on the results of your test and your observations, explain why clothespin _____ is the better one.

2. Based on the results of your test and your observations, explain why clothespin _____ is not the better one.

3. Present an unforeseen event or a problem you encountered during your experiment. Write what you did.

Cr2 Application of an appropriate procedure	Implementation of procedure	
Cr 4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions	

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Page 5

1. Reviewing the hypothesis

Following the results of his test, the student should have realised that one clothespin performs better than the other. The results of his test should reflect his choice of pins. He must then explain if his initial intuition was founded or not. You may prefer to work orally for this part, since the students are neither quick nor effective writers yet.

2. In the case of an inconclusive test

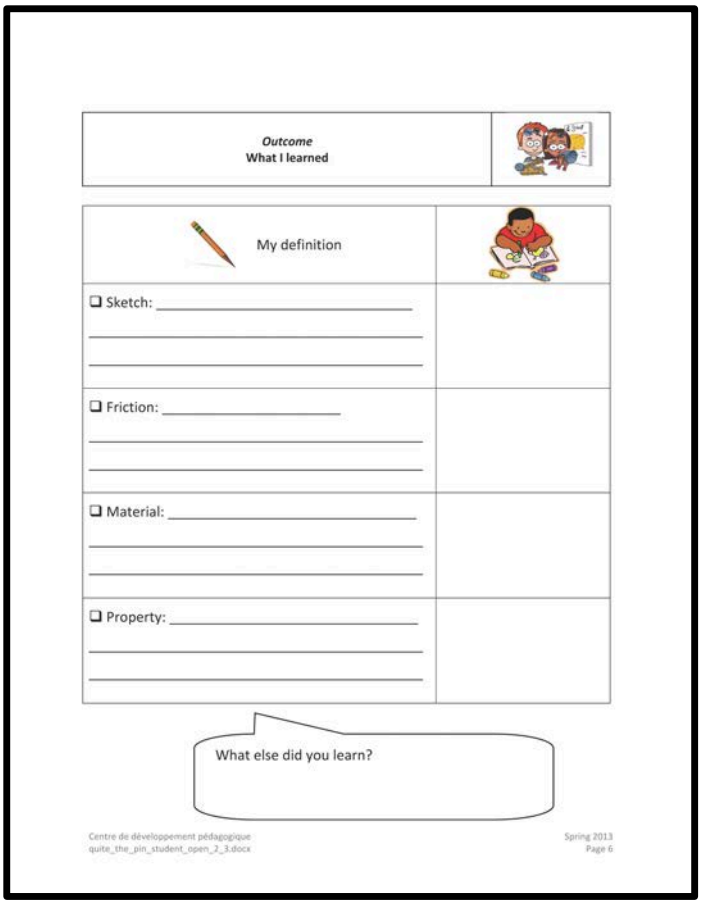
It is possible that some of the tests chosen by the students do not yield a conclusive result. It may then be interesting and relevant to take the time to explain to the students that this is a frequent occurrence among scientists. They will take into account the discoveries or mistakes in the course of their next tasks.

3. Unforeseen events and difficulties encountered

Finally, the students will also be requested to share their experience in class by relating the unforeseen events and problems they will have encountered in the course of the task. These may be of any order (difficulty of working in a group, difficulty noting results, broken materials, etc.)

4. What if the experiment were repeated

A "true" scientist will do an experiment over and over until he obtains the results required to arrive at an appropriate conclusion. In class, time often doesn't allow the work to be repeated. Thus, in a group discussion, we will ask the students what they would do to improve the experiment or we will inventory the tests carried out by the students.



Outcome
What I learned

My definition

❑ Sketch: _____

❑ Friction: _____

❑ Material: _____

❑ Property: _____

What else did you learn?

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Page 6

5. Learning

To conclude, it is important to recognise what has been learned. The knowledge acquired may be of any order. Some are techniques (e.g. using to use a ruler properly). Other learning may be vocabulary enrichment (e.g. recognise new words or various meanings for a word). There is also what has been learned about how to work in science and technology. A student may learn, for example, that it is not "bad" if his hypothesis is not the "right answer".

We suggest that you leave some time so the students can verbalise what they have learned.

Next, the vocabulary sheet on page 7 can be completed. The student can tick the new words learned and will also be invited to note his personal definition for the term and to illustrate the concept.

About the "right answer"

It is possible that even after testing his clothespins, a student may prefer the one that "fails" the test. If the student insists on keeping his initial choice and gives a valid justification (for example: I like the look or material of the object), the choice must be accepted, but be sure that the student understands the observed phenomenon correctly.

Evaluation

In the first cycle of elementary school, there is no obligation to communicate the evaluation of learning in science and technology. It is essential, however, to proceed with an evaluation to support the students' learning. To do so, we suggest you use the criteria in the evaluation framework of learning in science and technology for the 2nd and 3rd cycles of elementary school.

The table below allows the evaluation elements found in the student booklet to be retraced.

Evaluation criteria	**Elements promoting the understanding of the criteria**	**Page**
Cr1 Appropriate description of the problem	Reformulation of the problem	1 (orally)
	Formulation of a tentative explanation or solution	2
Cr2 Application of an appropriate procedure	Planning of work	3
	Implementation of procedure	In action + pages 3 and 4
	Readjusting the process, as required	In action + page 3 (different pencil)
Cr3 Appropriate use of instruments, tools or techniques	Handling of objects, tools or instruments	In action
	Observance of safety rules	
Cr4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions	4 and 5
	Use of terminology, rules and conventions specific to Science and Technology	Everywhere
Proficiency of subject-specific knowledge targeted in the *Progression of Learning* [2]	Material World	4, 5 and 6
	Strategies[3]	Everywhere

[2] It is important to remember to include learning related to techniques and instrumentation (section E) and appropriate language (section F) for each world.

[3] While feedback regarding this element must be provided to the student, it is not considered in the results communicated on the report card.

Suggestions for materials

Materials to be put at the students' disposal for a class of 28 students

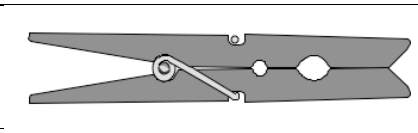
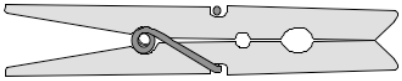
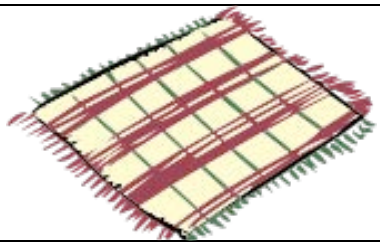
Items	Notes
14 clothespins — Model 1	Each team of two students should have two clothespins at their disposal. The choice of the model is the teacher's responsibility, but models of different materials (e.g. wood and plastic) with the same spring will allow the task to be better defined.
14 clothespins — Model 2	
14 rulers	The use if a ruler is optional. It is possible to invent any number of conclusive tests without resorting to conventional measurement. It is preferable to offer the use of a ruler, but not necessarily impose it.
14 – 50 cm pieces of string	The pieces of string may be used as a measurement tool or to model a clothesline.
28 - 10 cm X 10 cm squares of fabric	These squares may model clothing.
Elastics of various lengths and shapes	The elastics may be useful as measurement tools. They will stretch according to the force to which they are subjected.
Paper clips	The paper clips are useful to quickly make hooks.
Strips of paper and cardboard (about 3 cm wide X 25 cm)	The paper or cardboard strips may be used to model clothing or to note results. (A student may decide to glue them in the results booklet, in the space provided for results).
Glass pellets	The glass pellets may be used to increase the weight supported by the clothespins.
Cardboard glasses	The cardboard glasses may be used as containers to add weight.
Masking Tape	It is not recommended to supply the masking tape from the start. It may be requested by a student and its use remains at the teacher's discretion.

Complementary notes:

- Other than the clothespins, no other object is mandatory in the scenario proposed by the students.

ANNEX A

Available materials sheet

Clothespin Model 1	
Clothespin Model 2	
Ruler	
String	
Pieces of fabric	
Elastic	
Paper clip	
Strips of paper and cardboard	

ANNEX B

The clothespin