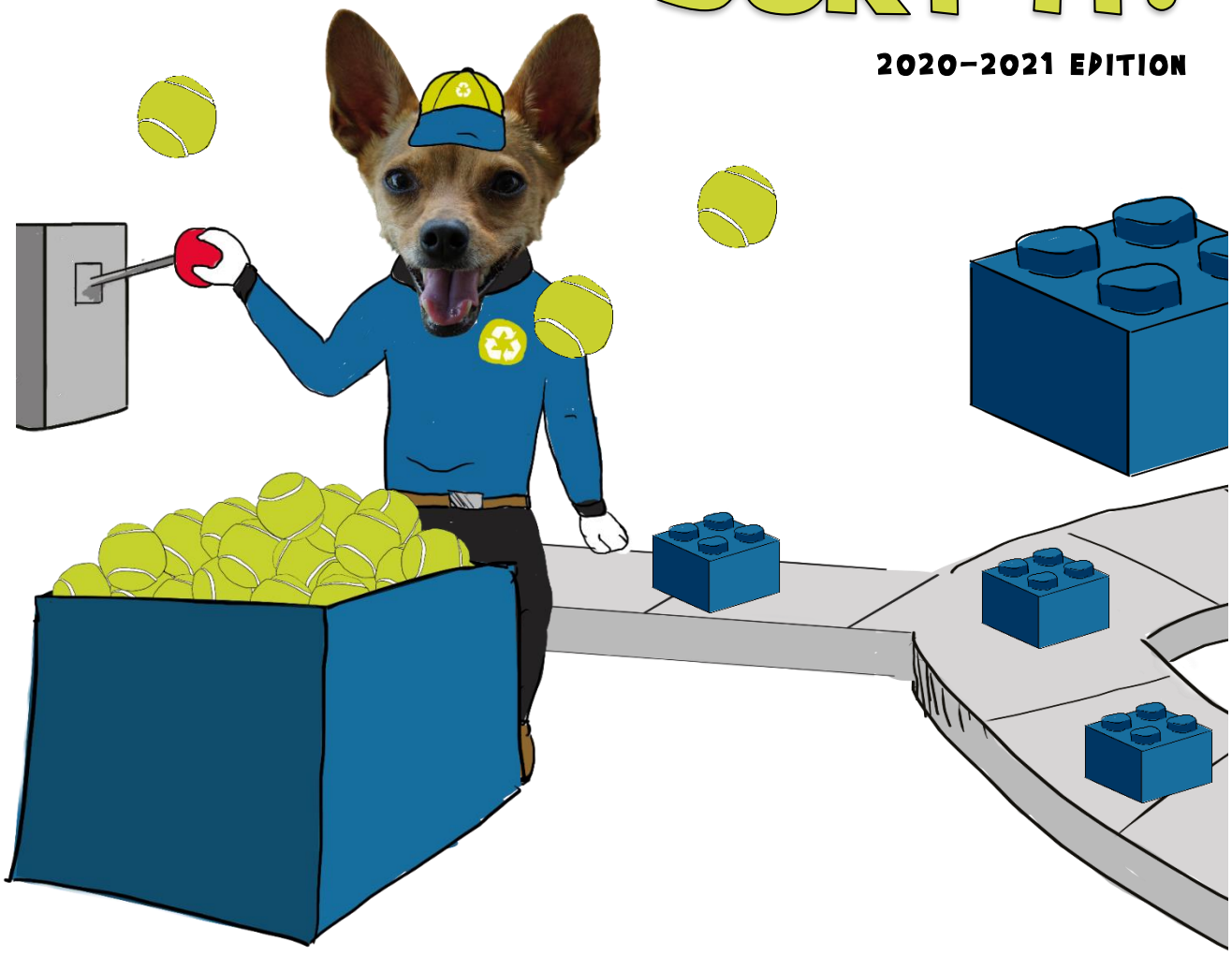
junior tech challenge

The practical side of science and tech

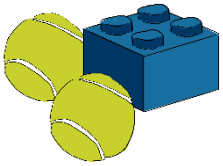
Teacher's Guide

SORT IT!

2020–2021 EDITION



Production team



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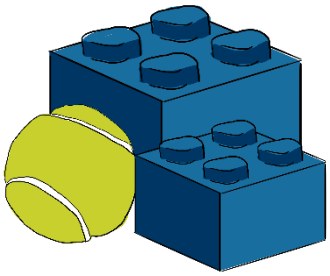


Introduction

The Junior Tech Challenge: a unique learning situation!

Every year in Quebec, the Junior Tech Challenge allows all elementary school students to learn about science and technology in a creative and fun way. The Junior Tech Challenge is an original and hands-on classroom project that is also a learning and evaluation situation (LES). Five challenges are presented cyclically, one per year. For each, educational tools are offered to meet the challenge of the current year. With each new edition, the rules and educational tools are improved upon to ensure that they best meet teachers' needs. The pedagogical content can be adapted according to the intended pedagogical objectives. This document is intended to support professionals who teach the Intensive ESL Project and the Science and Technology Program (Elementary), or anyone who wishes to experience the Junior Tech Challenge with their students in English.

A New and Adapted Challenge

This year, we are proud to offer you a new challenge that can be adapted to our new public health restrictions. The brand new, Sort It! challenge has been designed to be carried out at school in a team, with physical distancing... or not... or at home individually if conditions require it!

Teaching Tools Available

All documents have been translated into English and can be accessed on the following websites:

- Réseau Technoscience: http://www.technoscience.ca
- Elementary ESL Community: intensive-esl.quebec
- ESL Blogs: https://hosted.learnquebec.ca/eslcommunity/

    - Rules Handbook
    - Teacher's Guide
    - Student Handbook
    - Slide Presentation
    - Junior Tech Challenge Diploma
    - Excel spreadsheet (French only)
    - Scoring sheets to record points (French only)

Preparatory Activities

The preparatory activities aim to help students acquire scientific concepts related to the challenge. They also help develop strategies that support students in the development of science-specific competencies.

Although the activities can be carried out independently, they can lose their meaning if they are not developed in a meaningful context in which students can reinvest their knowledge in an authentic production. The activities allow the teacher to collect traces of the following skills in Science and Technology:

- Competency 1: To propose explanations for or solutions to scientific or technological problems.
- Competency 2: To make the most of scientific and technological tools, objects and procedures.
- Competency 3: To communicate in the languages used in science and technology.

All activities allow students to establish concrete links with scientific concepts anchored in the Progression of Learning Science and Technology and the Mathematics, Science and Technology program of Quebec.

For Intensive ESL Teachers

Teachers of Intensive ESL can use this challenge to develop Competency 1, *To interact orally in English,* while the students participate in hands-on activities that are motivating and challenging. The challenge can be experienced in the following ways: in the classroom only, at the service center's annual science competition, or in the regional finals. Many teachers from the same school may also participate, so the best teams may be selected to join the finals.

The students will have the opportunity to:

- Develop Competency 1 (Interact orally in English) through challenging hands-on activities.
- Review and consolidate science knowledge in an English-language context.
- Participate in a school-wide competition or a regional event.

For ESL Learners, a C1 evaluation tool, a functional language guide, and more ideas can be found in the ESL Extras section at the end of the Teacher's Guide.

From a LES for the Classroom to the Regional Finals

The Junior Tech challenge is an opportunity for students to experience a science and technology design in the classroom, and to experience something unique by participating in one of the many levels of competition-with the ultimate experience of participating at the Regional Finals!

Here are the different levels of finals:

Class Finals	Finals organized in class that determine the winners of each class.
School Finals	Finals per cycle to determine the representatives who will go to the school's service center's finals - or directly to the regional finals if there are no finals in your school service center.
School Service Center Finals	Finals per cycle organized by the school service center-alone, or in collaboration with Réseau Technoscience. If your school service center organizes finals, you will first be invited to register your students to these finals.
Regional Finals	Finals per cycle bringing together students from their region – 11 regional finals organized by Réseau Technoscience. The finals will take place in May, **virtually**, as part of l'Odyssée des sciences. Science fair projects from Expo-sciences and activities from the Club des Débrouillards will also be presented. Consult the calendar for the date of your Regional Finals. To register teams, you must use the online registration form that is found on technoscience.ca.

Note: During the Regional Finals, the challenge can be presented in a different format to that presented in the school service center finals. The students will be required to change their strategy on site to adapt to this new format. No advanced preparation is needed, but extra time will be given to students, if required, to make the necessary changes.

Progression of Learning for Science and Technology

This learning and evaluation situation is intended to help develop students' skills, particularly those associated with technological design. Many skills used during the design process are described in the activities proposed in the Teacher's Guide. The details of the concepts targeted in each of the activities and the links with the Progression of Learning are also presented below.

Knowledge activated in the LES

This learning situation activates the following knowledge from the Progression of Learning Science and Technology:

Material World

→	**Student constructs knowledge with teacher guidance.**	**Elementary**		
*	**Student applies knowledge by the end of the school year.**			
	Student reinvests knowledge.	**Cycle 1**	**Cycle 2**	**Cycle 3**

A. Matter	1st	2nd	3rd	4th	5th	6th
1. Properties and characteristics of matter						
a. Classifies objects according to their properties (e.g. colour, shape, size, texture, smell)	→	*				
b. Classifies materials (e.g. fabrics, sponges, papers) according to their degree of absorption	→	*				
e. Describes the shape, colour and texture of an object or a substance			→	*		
j. Describes various other physical properties of an object, a substance or a material (e.g. elasticity, hardness, solubility)					→	*
k. Recognizes the materials of which an object is made					→	*

→	Student constructs knowledge with teacher guidance.	Elementary		
*	Student applies knowledge by the end of the school year.			
	Student reinvests knowledge.	Cycle 1	Cycle 2	Cycle 3

C. Forces and motion	1st	2nd	3rd	4th	5th	6th
2. Magnetism and electromagnetism						
a. Recognizes the effects of magnetism on magnets (attraction and repulsion)	→	*				
b. Identifies situations in which magnets are used	→	*				
5. Characteristics of motion						
a. Describes the characteristics of motion (e.g. direction, speed)			→	*		
6. Effects of a force on the direction of an object						
a. Identifies situations involving the force of friction (pushing on an object, sliding an object, rolling an object)	→	*				
b. Identifies examples of a force (e.g. pulling, pushing, throwing, squeezing, stretching)			→	*		
c. Describes the effects of a force on an object (e.g. Sets it in motion, changes its motion, stops it)			→	*		
d. Describes the effects of a force on a material or structure			→	*		
7. Combined effects of several forces on an object						
a. Predicts the combined effect of several forces on an object at rest or an object moving in a straight line (e.g. reinforcement, opposition)					→	*

D. Systems and interaction	1	2	3	4	5	6
1. Everyday technical objects						
a. Describes the parts and mechanisms that make up an object	→	*				
b. Identifies the needs that an object was originally designed to meet	→	*				
4. How manufactured objects work						
a. Recognizes two types of motion (rotation and translation)			→	→	→	*
b. Describes a simple sequence of mechanical parts in motion			→	→	→	*

→	Student constructs knowledge with teacher guidance.	Elementary		
*	Student applies knowledge by the end of the school year.			
	Student reinvests knowledge.	Cycle 1	Cycle 2	Cycle 3

E. Techniques and instrumentation	1st	2nd	3rd	4th	5th	6th
1. Use of simple measuring instruments						
a. Appropriately uses simple measuring instruments (rulers, dropper, graduated cylinder, balance, thermometer, chronometer)			→	→	→	*
3. Use of tools						
a. Appropriately and safely uses tools (e.g. pliers, screwdriver, hammer, wrench, simple template)			→	→	→	*
4. Design and manufacture of instruments, tools, machines, structures (e.g. bridges, towers), devices (e.g. water filtration device), models (e.g. glider) and simple circuits						
a. Knows the symbols associated with types of motion, electrical components and mechanical parts			→	→	→	*
b. Interprets a diagram or a plan containing symbols			→	→	→	*
c. Uses symbols associated with mechanical parts and electrical components in a diagram or drawing			→	→	→	*
d. Draws and cuts parts out of various materials using appropriate tools			→	→	→	*
e. Uses appropriate assembling methods (e.g. screws, glue, nails, tacks, nuts)			→	→	→	*
f. Uses appropriate tools for proper finishing work			→	→	→	*
g. Uses simple machines, mechanisms or electrical components to design or make an object			→	→	→	*

F. Appropriate language	1	2	3	4	5	6
1. Terminology related to an understanding of the material world						
a. Appropriately uses terminology related to the material world	→	→	→	→	→	*
2. Conventions and types of representations specific to the concepts studied						
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)			→	→	→	*

Overview

1. Preparation

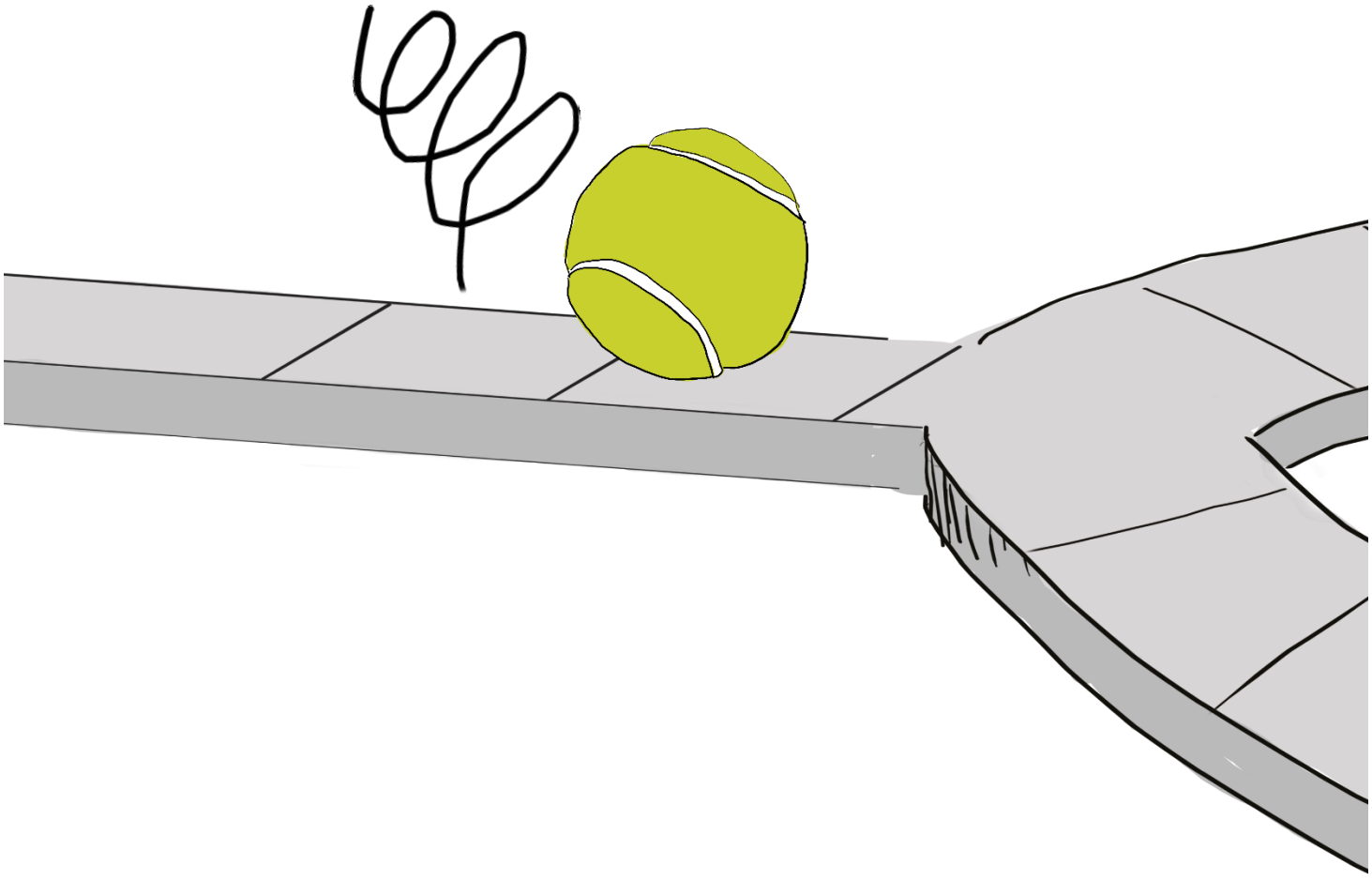
Description	Time	Pedagogical Materials
Setting the Stage The teacher presents the challenge to the students, but does not give them all the details. The rules and the objects to be sorted will be presented at a later time.	10 minutes	• Student Handbook p. 2, 3 • Presentation slides *Slides 2-4 (PPT version)* *Slides 2-8 (PDF version)*
Activity 1: Strategic Sorting Students are introduced to the concept of sorting, and the basic principles of operation of the tools used.	1 period	• Student Handbook p. 4 • Presentation slides *Slides 5-15 (PPT version)* *Slides 9-19 (PDF version)*
Activity 2: Birds of a Feather! Students learn to understand that there are several ways to classify objects according to their properties and characteristics.	1 period	• Student Handbook p. 5, 6 • Presentation slides *Slides 16-23 (PPT version)* *Slides 20-27 (PDF version)*
Activity 3: Let's Make an Impression! The students will examine an object from different angles in order to find the best way to pass it through a sorter. *Links made with Mathematics: solids and plane figures.*	1 period	• Student Handbook p. 7 • Presentation slides *Slides 24-28 (PPT version)* *Slides 28-32 (PDF version)*
Activity 4: Push, Pull, Turn! The students will analyze the technological aspects of a sorting center, and learn about its design. They will approach the concepts of force and motion within the context of the design.	1-2 periods	• Student Handbook p. 8-11 • Presentation slides *Slides 29-51 (PPT version)* *Slides 33-55 (PDF version)*
Activity 5: The Laws of Attraction Students are introduced to the properties of magnets.	1 period	• Student Handbook p. 12, 13 • Presentation slides *Slides 52-53 (PPT version)* *Slides 56-57 (PDF version)*
Preparing to Meet the Challenge The teacher presents the rules of the competition to the students. Students work on building different models of a sorter.	1 period or more	• Rules • Student Handbook p. 14-18 • Presentation slides *Slides 54-62 (PPT version)* *Slides 58-66 (PDF version)*

2. The Competition

Description	Time	Pedagogical Materials
The students build the sorter.	3-4 periods	• Materials allowed to be used to build the sorter. (See Rules) • Student Handbook p. 19

3. Intégration

Description	Time	Pedagogical Materials
The teacher and the students review the design and the construction of the sorter, and the strategies used to carry out the task.	20 minutes	• Student Handbook p. 20



Setting the Stage

Pedagogical Intentions

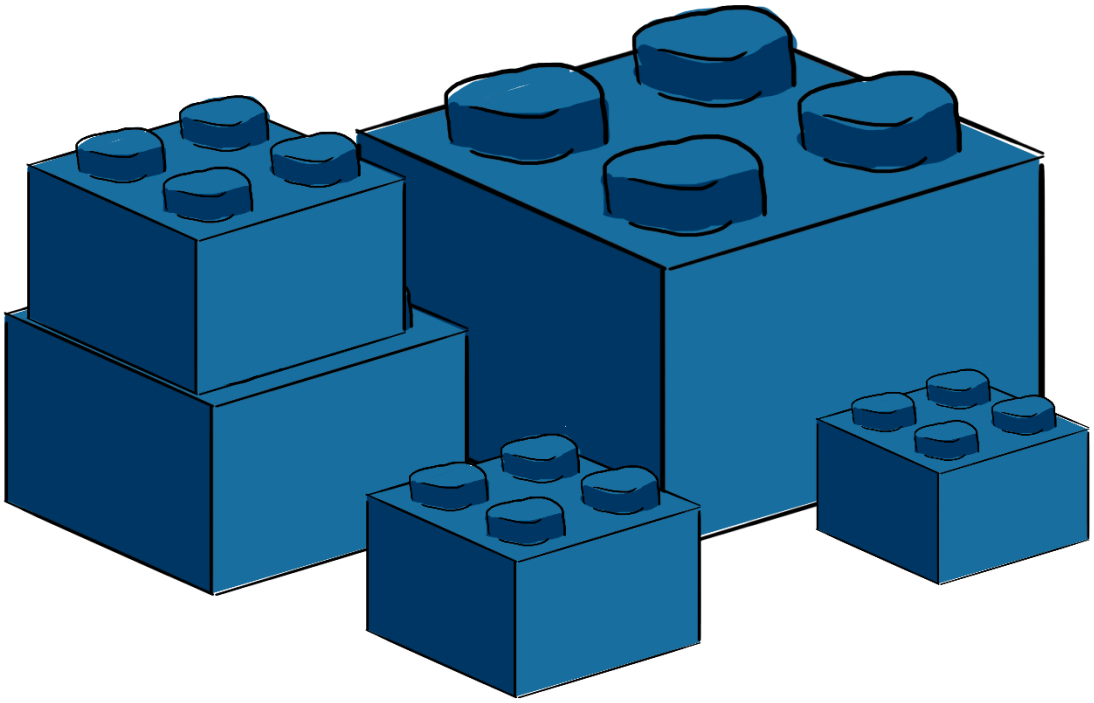
- Present the learning and evaluation situation and the challenge.
- Generate student interest in the challenge.

Materials

- Student Handbook p. 2, 3
- Presentation slides (slides 2-4 PPT version or slides 2-8 PDF version)

Procedure

- Use the slideshow to present an overview of the challenge to the students.
- Distribute the student handbook to generate interest.



Activity 1 - Strategic Sorting

Pedagogical Intentions

- Make a list of uses of various technological devices.
- Describe the basic principles of operation of technological devices.

Materials

- Internet connection
- Interactive White Board (IWB) or a projector
- Student Handbook p. 4
- Presentation slides (slides 5-15 PPT version or slides 9-19 PDF version)

Procedure

1) Watch one of the following videos (links can be found in slide presentation):

    - 3D Printed Coin Sorter
      https://www.youtube.com/watch?v=8AFQ-CHPNKY
    - Tea Box Conveyor Sorter
      https://www.youtube.com/watch?v=_k_gkeIQtts
    - Metal/Aluminium Conveyor Sorter
      https://www.youtube.com/watch?v=Do_BPfDt1nI
    - Marble size sorting machine (0:00 - 1:23)
      https://www.youtube.com/watch?v=ya9zTstjOIU
    - Apple sorting machine
      https://www.youtube.com/watch?v=-HiJHaPqblM

2) Inform students that they will be watching a video, and they must:
    - Identify the purpose of the machine.
    - Explain how the machine sorts (separates) objects.

3) Watch the video with the students. It can be viewed several times.

4) Discuss :

- What is the machine used for?
- How does the machine separate, or sort, objects?

Examples of possible answers:

- ✓ This machine sorts coins.
- ✓ It sorts the coins by size. A different-sized slot is needed for different sized coins.
- ✓ The smaller coins pass through the smaller slots, and the bigger coins pass through the bigger slots.
- ✓ The slots are located along a rail on which the coins slide down. The slots are organized from the smallest to the largest. Smaller coins are sorted first and larger coins at the end.
- ✓ When a coin is sorted, it falls into a container.

5) Repeat the activity with the other videos.

Strategic Sorting

Activity 1

To complete the challenge, you must build a sorter. You probably already know different types of machines that sort materials. Let's look at some of them.

Watch the video, *Trieur de pièces imprimées en 3D* (3D Printed Coin Sorter). Complete the table below by drawing the objects that are sorted by the machine, and explaining how it works. Repeat the procedure after viewing the other videos.

Sorted objects	How does it work?
Example 	• *The machine scans the barcode of the item to find out what it is made of.* • *It sends the cans to one side and the bottles of the other.*
Coins	• The coins pass through different-sized slots. • Coins of the same size are stacked together.
Tea boxes	• Small cameras scan the colour of the boxes. • Different colours go in different directions.
Metal and aluminium	• A magnet passes over the shavings. • The metal shavings are attracted to the magnet and are separated from the rest.
Marbles	• The marbles roll between 2 metal rods. • The space between the metal rods becomes larger to allow the different-sized marbles to pass through.
Apples	• The apples pass through openings of different diameters. • The apples fall into the holes corresponding to their size.

Intensive ESL Vocabulary to Explore: pass through, fall into, roll, stack together, slot/opening/hole, shavings, magnet, metal rod.

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Activity 2 - Birds of a Feather…!

Pedagogical Intention

- To help students understand that there are many ways to classify objects according to their properties and characteristics.

Materials

- Student Handbook p. 5, 6
- Presentation slides (slides 16-23 PPT version or slides 20-27 PDF version)
- Make bags of 10 different objects from the following list (1 bag per team):

○ Plastic caps ○ Plastic lids ○ Glass marbles ○ Metal marbles ○ Nails ○ Coins ○ Tothpicks ○ Rubber bands ○ Paper clips ○ Centicubes ○ Bolts	○ Screws ○ Popsicle sticks ○ Small wooden cubes ○ Transparent plastic pots ○ Transparent plastic rules ○ Plastic tokens ○ Metal washers ○ Blue sticky tack	○ Plasticine ○ Pieces of fabric ○ Felt ○ Bits of string ***Objects suggested to help sort and classify these objects:*** ○ Magnets ○ Magnifying glasses (optional)

Procedure

<u>Part A</u> – Examples of classification criteria

1) Present the image of the buttons already classified in slide 17 PPT (21PDF). Ask students which criterion was used to classify these objects, and what categories were chosen.
   - Slide 16 PPT (21 PDF): The buttons are classified by **size** (criterion) The categories are:
     - The small buttons are smaller or equal in size to the red ruler.
     - The medium-sized buttons are larger than the red ruler, but smaller or equal in size to the green ruler.
     - The large buttons are larger in size to the pink ruler
   - Slide 18 PPT (22 PDF): The buttons are classified by **colour** (criterion) The categories are: pink, purple, blue etc.
   - Slide 19 PPT (23 PDF): The buttons are classified by **shape** (criterion) The categories are: circle, triangle, polygon, etc.

2) Present images of everyday objects in the slideshow and ask students to sort them.
   - Slide 20 PPT (24 PDF): Discuss how these everyday objects can be sorted (classified).
   - Slide 21 PPT 9 (25 PDF): These objects are classified according to waste management criteria. This second image shows the objects sorted into the following categories – *recyclable plastics, non-recyclable plastics, metals, materials destined for the sorting center and compostable (biodegradable) materials.*
   - Suggestion: Consult your city's recycling guide. (Example: City of Laval).

3) Present the video classement des blocs LEGO® (YouTube).
   - Ask students to identify the classification criterion: **Size**
   - Discuss the limitations of this classification: **Some of the bigger pieces can sometimes pass through the holes vertically.**

Part A: Examples of classification criteria

Complete the table after viewing the images of the sorted objects.

Photo	Criteria	Categories
Example	*Mass*	• *More than 2 kg* • *2 kg* • *Less than 2 kg*
#1	Colour	• Pink • Red • Blue • Black • Purple • Green • Violet • Yellow • Orange • White
#2	Size	• Small: red ruler and < • Medium: > red ruler and < pink ruler • Large: > pink ruler and +
#3	Shape	• Circle • Triangle • Rectangle • Flower • Polygons (6-8 corners) • Star or heart

<u>Part B</u> – My criterion

1) Distribute a bag, consisting of 10 objects, to each team.

2) Ask students to choose a criterion to classify their objects, and define their categories. (Examples of different criteria: size, type of material, buoyancy, rolling or sliding, magnetism, texture, shape, colour, etc.)

3) Ask students to draw or list their chosen criterion, and name each group/category (Student Handbook, p. 6.).

4) Ask each team to exchange their items with another team, and submit their classification criterion.

5) Ask each team to classify the objects according to the first team's criterion, and then compare the result of their classifications.

6) Lead a group discussion: Have we arrived at the same classification? If not, which objects are not classified in the same way? How do we explain these differences?

Optional Activities for Vocabulary Practice (Cycle 1 and ESL)

- Play the game "Guess What's in the Bag": The student touches an object hidden in a bag, describes it using classification criteria and names it.
- Play "20 Questions" to identify an object chosen by a student.

Functional Language Suggestions for ESL Learners

Size	Shape	Colour	Material	Uses
It's smaller than...	*It's round.*	*It's silver.*	*It's made of plastic.*	*It can be used to seal jars.*
It's bigger than…	*It's square.*	*It's orange.*	*It's made of metal.*	*It can be used to…*
It's about the same size as…	*It has a hole in the middle.*	*It's beige.*	*It's made of wood.*	
It's…	*It's flower-shaped.*	*It's white.*	*It's made of…*	
	It's long.	*It's clear.*		
	It's…	*It's…*		

Activity 3 - Let's Make an Impression!

Pedagogical Intention

- The students will observe an object from different angles in order to find the best way to pass it through a sorter.
  Links made with Mathematics: solids and plane figures.

Materials

- Student Handbook p. 7
- Presentation slides (slides 24-28 PPT version or slides 28-32 PDF version)
- Macaroni
- Marbles
- Ping pong balls
- Centicubes
- Plastic tokens (Bingo chips)
- Metal washers
- Plasticine

Procedure

1) Present these 7 objects to each team:
   - Macaroni
   - Marble
   - Ping pong ball
   - Centicube
   - Plastic token (Bingo chip)
   - Metal washer
   - Plasticine

2) Explain that the objects that will be sorted by the sorter will fall in different directions and that it is important to know the 2D impression of these objects. Remind students about what they learned from watching the video, *classement des blocs LEGO®* in the previous activity.

Part A – Observing different impressions

3) Distribute the 6 objects and the plasticine to each team.

4) Ask students to make an impression of one of the objects by pressing it into the plasticine several times using different sides of the object (about 3 cm thick). Ask them to try to obtain as many different impressions as possible.

5) Ask students to copy the impressions in Student Handbook p. 7.

6) Ask students to follow the same procedure for the other 5 objects.

7) Lead a class discussion using slides 24-28 PPT (28-32 PDF):
   - Are there any impressions that resemble each other?
   - Why is it important to study the impressions of the objects to be sorted?

Part B – What's my impression?

1) Each team chooses 12 objects from the list in Activity 2, p. 15.

2) One student chooses an object from the list without telling their teammate what it is, and makes an impression of the object in the plasticine.

3) The other student identifies the object by its impression. Students take turns making impressions and guessing what they are.

Functional Language Suggestions for ESL Learners

Student A	Student B
What do you think this object is?	*Is it (colour)….?*
No, try again.	*Is it used for…?*
Yes! Now it's my turn to guess.	*Is it made of (material)…?*

Activity 4 - Push, Pull, Turn!

<u>Part A</u> – Identifying different types of motion

Pedagogical Intention

- The students will analyse the technological aspects of a sorter, and learn about its design.
- They will approach the concepts of force and motion within the context of the design.

Materials

- Student Handbook p. 8, 9
- Presentation slides (slides 29-39 PPT version or slides 33-43 PDF version)

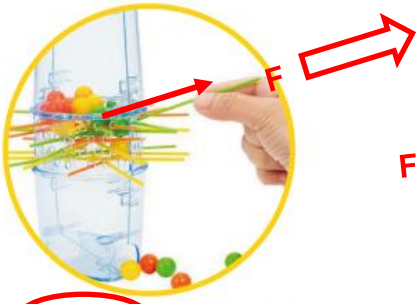
Procedure

1) Present slides 30-32 PPT (34-37 PDF) to the students to review the concepts of force and motion.

2) Present slides 33-39 PPT (38-43 PDF), and Student Handbook pages 8, 9 and ask students to:
   - Identify and circle the type of motion that is represented in each image (rotation or translation).
   - identify with the symbol of force where the force must be exerted in order to displace the movable part (see Teacher's Guide, p. 22). For some objects, more than one answer may be possible, for example the latch can also rotate.
   - identify the resulting movement with the symbol of motion (see Teacher's Guide, p. 22).

Functional Language for ESL Learners

FORCE	MOTION
*The force is being applied toward the object. (I am **pushing** the movable part **toward** the object.)*	*The motion is translational. The object moves sideways after the force is applied.*
*The force is being applied away from the object. (I am **pulling** the movable part **away from** the object.)*	*The motion is rotational. The object moves in a circular motion after the force is applied.*
*The force is being applied down. (I am **pushing** the movable part **down**.)*	



Translation or rotation ?

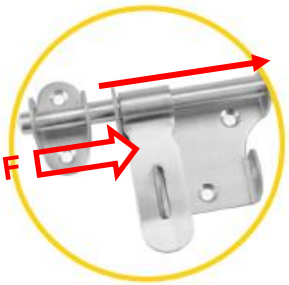
Translation or rotation ?

Push, Pull, Turn!

Activity 4

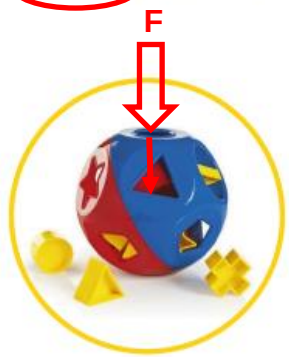
Part A: Identifying different types of motion (cont'd)

Translation or rotation ?



Translation or rotation ?

Translation or rotation ?



Translation or rotation ?

Part B – Implementing the design

Pedagogical Intention

- To design a technological system that will help the students become familiar with the construction of opening and closing systems that allow the passage or retention of objects of different sizes.

Materials

- Student Handbook p. 10, 11
- Presentation slides (slides 40-51 PPT version or slides 44-55 PDF version)

- Cardboard box (tissue, cereal, cookie)
- Cardboard
- Brochette skewers
- Popsicle sticks
- Pipe cleaners
- Straws
- Adhesive tape
- Sticky tak
- Paper fasteners
- String
- Rubber bands
- Magnets
- Scissors
- Hot-glue gun (to be used by the teacher)
- Marbles
- Ping pong balls

Procedure

1) Present videos of the different opening and closing systems that allow objects to pass through an opening. Links can be found in slides 40-50 PPT (44-54 PDF).
   - Translation : Avec quatre bâtons de sucettes glacées
     (Translation : With 4 popsicle sticks)
   - Rotation : Découpe trois côtés (porte à charnière)
     (Rotation : Three-sided cut-out - hinged door)
   - Rotation : Découpe quatre côtés (porte à charnière)
     (Rotation: Four-sided cut-out - hinged door)
   - Rotation : Cercle avec ouverture (3/4)
     (Rotation: Circle with an opening ¾)
   - Translation : Bâtonnets
     (Translation: Popsicle sticks)
   - Translation : Piques à brochette
     (Translation: Brochette sticks)

2) Ask students to build at least 2 systems that will allow a marble and a ping pong ball to exit and enter a cardboard box.

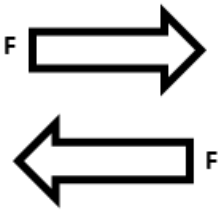
3) Discuss the advantages and disadvantages of each system. Slide 51 PPT (55 PDF).

4) Ask students to make a sketch of their systems in their Student Handbook, and indicate the symbols of force and motion. *

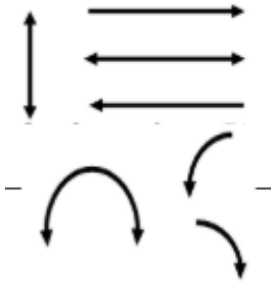
5) Ask students to circle or write down the action produced by the force applied. (Push, pull or turn).

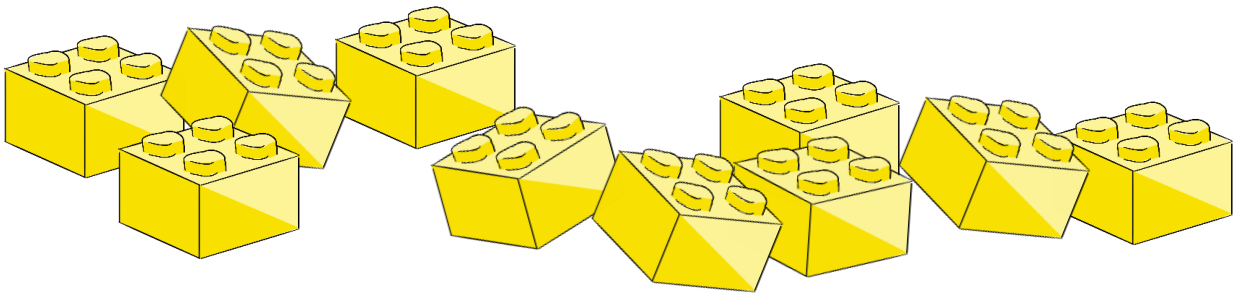
* Be careful to use the correct type of arrow to represent force and motion.

Symbols of force



Symbols of motion





Activity 5 - The Laws of Attraction!
(recommended for cycles 2 & 3)

<u>Part A</u> – The properties of a magnet

Pedagogical Intentions

- Introduce students to the properties of magnets, the properties of objects attracted to magnets (ferromagnetic), and the properties of objects not attracted to magnets (non-magnetic).

Materials

- Student Handbook p. 12
- Presentation slides (slides 52-53 PPT version or slides 56-57 PDF version)
- Magnets
- Non-magnetic objects (some may be attracted by a magnet, others may not)
    - A popsicle stick
    - An aluminum can tab
    - A paper clip
    - A plastic cap
    - The metallic tip of a pencil
    - An eraser

Procedure

1) **My hypotheses**: Students are asked to predict what will happen to each object as it approaches the magnet, and write their hypotheses (predictions) in the table on page 12 of their Student Handbook. See p. 34 for functional language for ESL learners.
    - If they predict that the object will be attracted to the magnet, they write A.
    - If they predict that the object will be repelled by the magnet, they write R.
    - If they predict that nothing will happen, they write X.

2) **My observations**: Students will bring the magnet closer to the objects, observe what the magnet does, and take notes in the table on page 12 of their Student Handbook.
    - If the object is attracted to the magnet, they write A.
    - If the object is repelled by the magnet, they write R.
    - If nothing happens, they write X.

3) Discuss the different observations and compare answers:
    - A magnet attracts some metal objects.
    - A magnet does not attract plastic, wood and some metals.
    - A magnet can attract or repel another magnet.

Part B – Differences between magnets

Pedagogical Intention

- To discover that magnets have different strengths depending on their shape, their size and their thickness.

Materials

- Student Handbook p. 13
- Magnets of different shapes, sizes and thicknesses
- Ruler
- Paper clips

Procedure

1) Ask students the question, “Do you think that all magnets have the same magnetic force?”. Ask them to write their answer in their Student Handbook.

For the experiment, students:

2) …place a paper clip at one end of a ruler, and a magnet on the other end.

3) …slowly bring the magnet closer to the paper clip and make an "X" where the magnet begins to attract it.

4) …use the ruler to measure this distance, and note it in their Student Handbook.

5) ...repeat this procedure with the other magnets.

6) Next, ask students to get a second paper clip. Without removing the first paper clip from the magnet, try to attract a second, then a third and a fourth etc.

7) Students note how many paper clips the magnet attracts.

8) Following the experiment, ask students to conclude which of the magnets used is the strongest. Ask them to explain their answer.

Part C - Using magnets through different materials

Pedagogical Intention

- Discover that a magnet can work through different substances.

Materials

- Student Handbook p. 13
- Paper cup
- Plastic cup
- Paper clip
- Water
- The strongest magnet found in part B

Procedure

1) Before the experiment begins, place a paper clip in each cup, add water to it, and give one glass to each team.

2) Ask students the following question: “How can you remove the paper clip from the water without wetting your hands?”.

   Here are the possible hypotheses:
   - Use tweezers
   - Wear gloves
   - Use a magnet and a string
   - Empty the water
   - Use chopsticks
   - Drink the water
   - Etc.

3) Ask students to test some of their hypotheses. They will discover that it is possible to accomplish the task using a magnet. Distribute one magnet per team.

   It is important to use both a plastic and a cardboard cup so that students will realize that a magnet works through different materials.

4) Explain to students that magnets act through different materials (e.g., plastic and cardboard) and through different substances (e.g., water).

Preparing to Meet the Challenge

Pedagogical Intention

The teacher presents the rules of the competition to the students. Students work on building different models of a sorter.

Materials

- Rules
- Student Handbook p. 14-18
- Presentation slides (slides 54-62 PPT version or slides 58-66 PDF version)
- Material necessary to design the sorter

Setting the Stage

During the finals of the Junior Tech Challenge, students will be asked to sort 3 different types of objects using their sorter.

Procedure

1) Review the rules of the competition using the presentation slides, and present the objects to be sorted:
    - 10 marbles
    - 10 centicubes
    - 10 metal washers *(12,7 mm inside diameter et 34,93 mm outside diameter)*

2) Assign or let students form teams of 1 or 2.

3) Present Student Handbook p. 14, 15.

4) Review the hypotheses discussed in the previous activities.

5) Discuss the following:
    - How could the shape and the thickness of an object influence the design of the sorter?
    - In what order could the objects be sorted?
    - Which systems (doors, holes, etc.) can be used to sort these objects?

6) Remind students that before building the sorter, the teams must:
   - select the material they want to use to build their sorter.
   - draw a sketch of their prototype in Student Handbook p. 16.

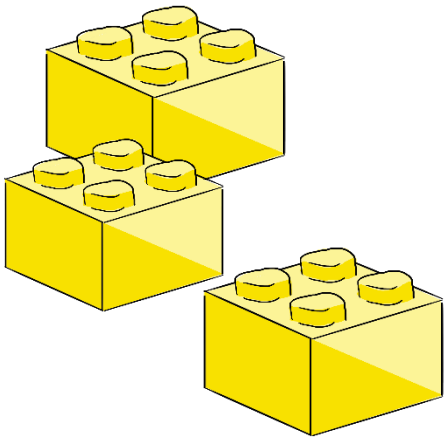
   Note to the teacher evaluating Science and Technology: The students' proposals can be presented orally or in writing. Therefore, the use of these pages may vary from one student to another. Refer to Evaluation Grid, Appropriate description of the problem, page 30.

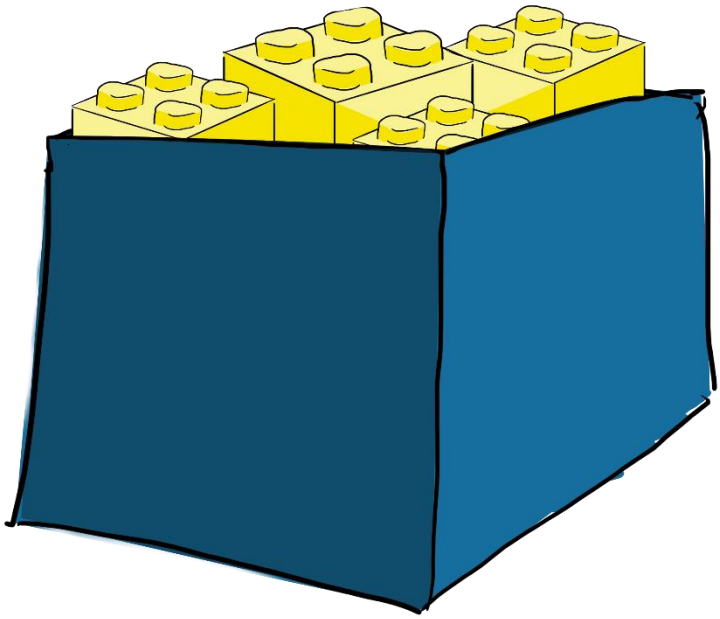
7) Each team or teammate builds a sorter in preparation for the challenge.

8) Each team tests their prototypes and completes the tables in Student Handbook p. 17, 18.

9) Each team will modify their original prototype as needed.

10) During the testing of the prototypes, the teacher supports the students by questioning them, encouraging them and guiding them in their adjustments. He or she also collects observations on how students designed their sorter within the constraints of the challenge. For ESL learners, the teacher can make observations on how students interact orally, ie. how they use the vocabulary and the functional language provided.





The Competition - In-class or school-wide

Materials

- Student Handbook p. 19
- Rules

Procedure

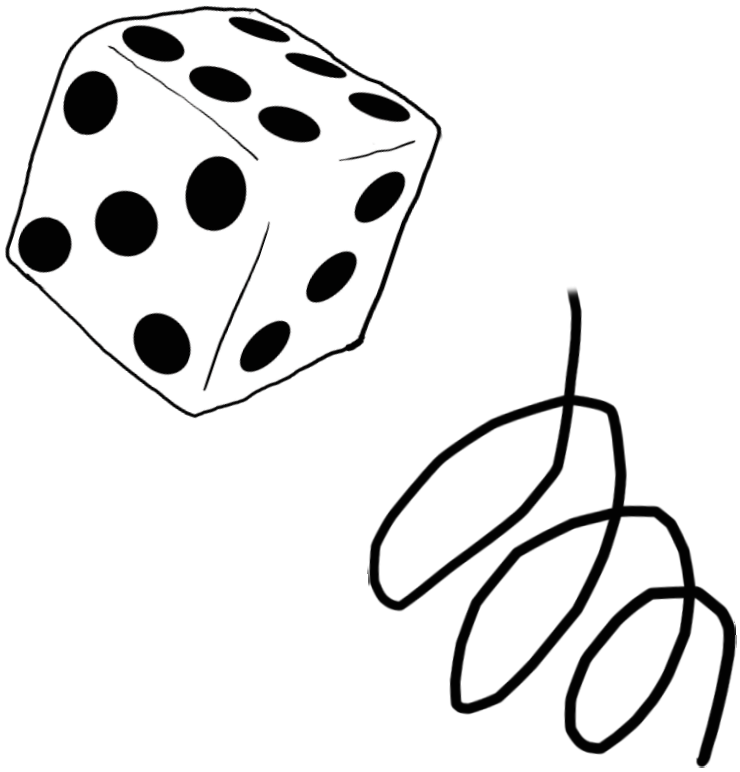
You will find all the necessary information for how to organize the competition in the classroom in the *Rules*. Once the competition is done, students are invited to write their scores in Student Handbook p. 19.

Let's Review!

Review the results with the students and invite them to complete the last page of Student Handbook p. 20.

Frequently Asked Questions

Frequently Asked Questions are updated weekly on the Réseau Technoscience website. Visit the Frequently Asked Questions section and feel free to ask your question if the information you are looking for is not there.



Let's review!

Pedagogical Intentions

- Consolidate learning.
- Provide feedback to the students on the design and construction of their sorter, as well as on the strategies used to carry out the challenge.

Materials

- Sorters designed by students for the competition
- Student Handbook p. 20

Procedure

1) Ask students to present their sorters, the modifications made during the trials, and their final results.

2) Compare the differences between the sorters and ask the following questions:
   - Why did some sorters work better than others?
   - Why did some sorters work faster than others?

3) Question students about the strategies they used. Which ones were more effective than others?

4) Ask students what they learned and what they will remember most from this project.

Evaluation Grid - Science and Technology

<table>
<tr><th>Evaluation Criteria</th><th>A</th><th>B – C – D</th></tr>
<tr><td rowspan="3">Appropriate description of the problem</td><td rowspan="3">Formulation of complete and relevant solutions.
(Student Handbook and observations made in class)

The student proposes relevant solutions of the design, orally or through the sketch drawn in the Student Handbook:
that three different objects must be sorted;
that the sorting should not be done with hands or with any instruments;
that the sorter must respect the required dimensions.
Note: We are not assessing the efficacy of the design. We want to check whether the student can identify the important elements of the design, and to propose possible solutions before its construction.</td><td>B: The student proposes relevant solutions of the design, orally or through the sketch drawn in the Student Handbook by identifying the elements mentioned in A. Some omissions are observed.</td></tr>
<tr><td>C: The student proposes relevant solutions of the design, orally or through the sketch drawn in the Student Handbook by identifying the elements mentioned in A. Many omissions are observed.</td></tr>
<tr><td>D: The student does not propose any relevant solutions neither orally or in the Student Handbook.</td></tr>
<tr><td rowspan="3">Application of an appropriate procedure</td><td rowspan="3">Readjustment of the design made during the testing phase.
(Student Handbook and observations made in class)

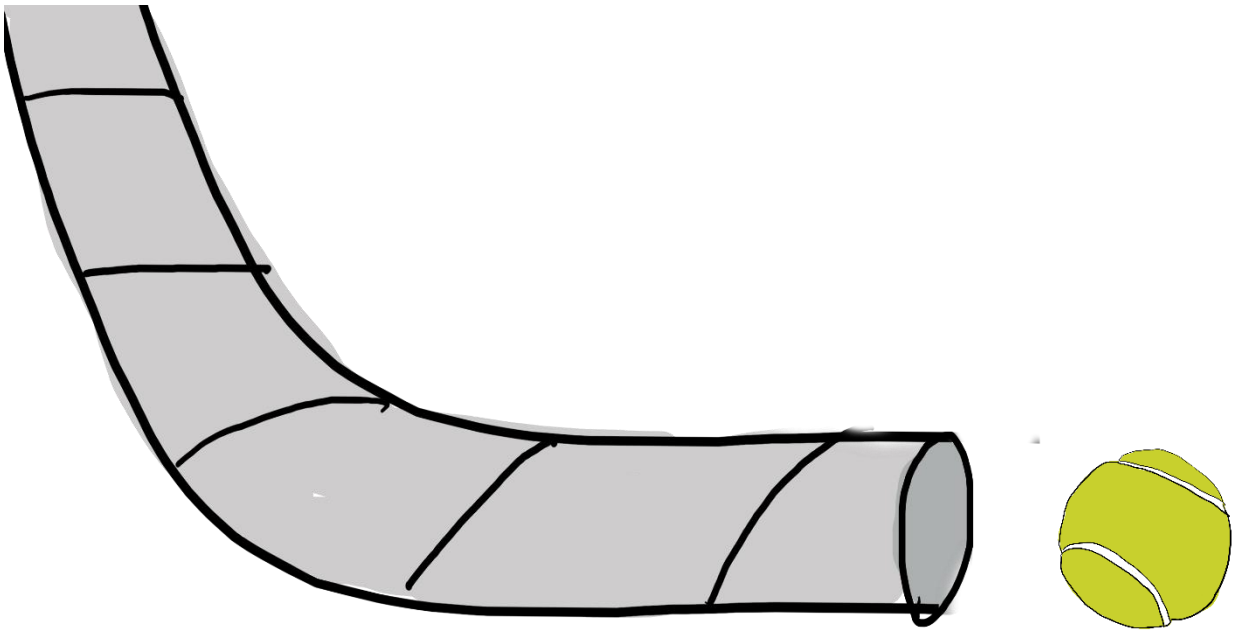
During the testing phase, the student identifies three problems encountered, and offers a number of relevant solutions for each, either orally or written.

Note: The solutions proposed do not necessarily have to be successful.

Some trials may be successful. Either way, evaluate trials where a problem and a modification have been described.</td><td>B: During the testing phase, the student identifies two problems encountered, and offers a number of relevant solutions for each, either orally or written.</td></tr>
<tr><td>C: During the testing phase, the student identifies one problem encountered, and offers a relevant solution, either orally or written.</td></tr>
<tr><td>D: During the testing phase, the student does not identify any problems.</td></tr>
</table>

Evaluation Grid (continued)

Critères d'évaluation	A	B – C – D
Appropriate use of instruments, tools or techniques	**Appropriate handling of tools and instruments.** (Observations made in class with the manipulation of the prototype) The student appropriately uses the techniques taught in class.	B-C: The student appropriately uses the techniques taught in class. Some awkwardness is observed.
		D: The student does not appropriately use the techniques taught in class.
Appropriate use of scientific and technological knowledge	**Produces explanations and uses terminology specific to Science and technology.** (Student Handbook) The student summarizes: • by describing their best idea AND a modification; • by using the terminology specific to Science and Technology.	B: The student summarizes by describing their best idea AND a modification, and by using the terminology specific to Science and Technology. Some inaccuracies are observed.
		C: The student summarizes by describing their best idea OR its modification, and by using the terminology specific to Science and Technology.
		D: The student simply presents their ideas without any explanation, or the explanation provided is not based on Science and Technology.



Intensive ESL Extras

You will find

Activity Suggestions

1. Competency 1: To interaction orally in English

Use the evaluation tool to observe students as they are planning their design and performing the various tasks. Use the functional language poster as support, and ask students to add to it by brainstorming other possible phrases to practice.

2. Competency 3: To Write Texts

- Have the students write a procedure for the competition to make sure they will succeed at the challenge (a step-by-step preparation).
- See I Write Texts Checklist.

Example: First, we must…
Then, we must not forget to…
Assemble the… on the… is very important…

3. Consolidating and reflecting

Consider these questions during a group reflection, or have the students complete a reflection sheet or a journal entry.

- Describe how knowledge of science concepts can be useful in everyday life.
- What was your favourite part of the challenge? Explain.
- What did you find the most difficult part of the challenge? Explain.
- Name something you learned about teamwork while completing this challenge.
- How did you "fail forward" during the design and construction of the challenge?

Journaling

- Ask students to journal their experience every day, either on a collaborative platform or in a personal journal, to share with their classmates or not.

Vocabulary to Explore

Students can illustrate or write the definitions, and add more idioms or vocabulary to the table.

Idioms	Vocabulary
Setting the stage	criterion: criteria:
To break down	hypothesis: hypotheses:
No time to waste	prototype :
Birds of a feather flock together	
Make an impression	
Opposites attract	
Meet the challenge	

General Functional Language Suggestions

What do you think? Why?

Do you agree? I agree / I disagree

I think that... because...

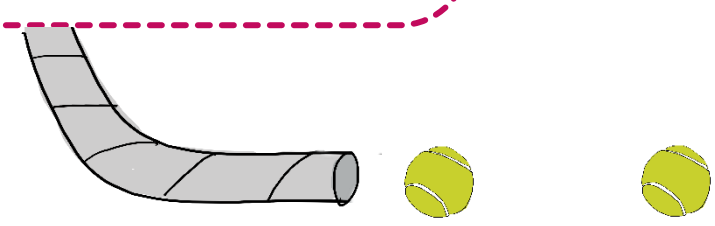
I don't think... because...

While making predictions

- I think that…
- I predict that…
- What do you think will happen?
- What do you predict will happen?

While making observations

- My prediction was accurate/inaccurate.
- I think it was accurate because…
- I think it was inaccurate because…
- Were your predictions accurate?



C1 rubric to evaluate your students' oral interaction while doing the different activities

ELEMENTARY CYCLE THREE ESL GENERIC EVALUATION TOOL

Competency 1, *To interact orally in English*

Class : _____

Evaluation criteria : Participation in exchanges and Use of functional language				Student names		
	Participation in exchanges	**20**	Speaks throughout, contributing substantial content, AND uses techniques to create true interaction (e.g. asks partner questions, reacts to and builds on partner's ideas)			
		16	Speaks throughout, contributing substantial content.			
		12	Speaks throughout, contributing limited content.			
		8	Speaks sporadically.			
		4	Speaks rarely.			
	Use of vocabulary and useful expressions	**15**	Quickly accesses a variety of vocabulary and expressions.			
		12	Uses a variety of vocabulary and expressions.			
		9	Uses basic vocabulary and expressions.			
		5	Lacks vocabulary.			
	Comprehension of messages by an anglophone	**15**	Messages are easily understood despite errors, if any.			
		12	Messages are understood with **some** interpretation.			
		9	Messages are understood with **considerable** interpretation.			
		6	Some messages are not understood despite interpretation.			
		3	Messages are understood; however, they are brief, very simple and/or very few.			
			Total : **/50**			
			Challenges (see list below)			

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Special cases :

- If a student does not participate or does not speak in English, allot 0/50.
- If most or all messages cannot be understood, allot 0/50.

Challenges		
	1. Using English words	8. Building on what partner says
	2. Pronouncing keywords clearly	9. Reacting to what partner says
	3. Using a variety of words	10. Initiating an exchange
	4. Expressing more ideas	11. Using vocabulary from available resources
	5. Elaborating on ideas (giving examples, details, etc.)	12. Using a specific language convention : _____
	6. Expressing a personalized messages	13. Using the strategy : _____
	7. Asking questions to maintain interaction, ask for details, ask for clarification, etc.	14. _____

C3 I Write Texts Checklist

CHECKLIST

To write texts

I Write Texts

1. I prepare to write.

- I think of the instructions.
- I take out the resources I need (my books, my dictionary, my bank of expressions . . .)
- I look at the model.
- I write down ideas in English.
- I put them in order.

2. I write a draft.

- I look at the model again.
- I follow the instructions.
- I use my ideas.
- I write short sentences in English. (Subject / Verb / Object)
- I use the vocabulary and expressions I know.
- If I have a problem:
  - I ask for help, I use my bank of words . . .

3. I revise my text.

- Did I follow the instructions?
- Did I follow the model?
- Are my ideas original?
- I check the spelling, the word order and punctuation with the resources I have.
- I ask a friend to revise my text.
- I correct my text.

4. I write my final text.

- Is it OK?
- Is it neat?
- Is it easy to read?

C3 Generic Evaluation Tool

Elementary Cycle Three Generic[1] Evaluation Tool for Competency 3, *To write texts*

Name of student: _____ **Class:** _____

Evaluation criteria: Characteristics of the written text and Application of targeted language conventions

For marks and feedback purposes	For feedback purposes + = good job | – = to work on	
	Content	**Form**
› *Comprehension of the text by an anglophone* 10 The text is easily understood despite errors, if any. 8 The text is understood with **some** interpretation. 6 The text is understood with **considerable** interpretation. One or two sentences may not be understood. 4 Parts of the text are not understood despite interpretation.	+ – clarity + – detail + – flow + – paragraphing + – pertinence + – other: _____	+ – articles + – capitalization and/or punctuation + – prepositions + – pronouns / possessive adjectives / possessive forms + – sentence structure (e.g. word order) + – singular/plural + – spelling + – verbs (e.g. tense, agreement) + – vocabulary + – other: _____
› *Introduction or introductory sentence* 1 Effective 0 Ineffective 0 Missing	+ appropriate + catchy + original + useful + other: _____	– does not make sense – inappropriate or not pertinent to the task or context – incomplete – unclear – other: _____
› *Body of the text* 3 Effective 2 Mostly effective 1 Mostly ineffective 0 Ineffective	+ accurate + complete (all necessary information) + easy to follow + pertinent + well developed + well organized + other: _____	– essential information missing – inaccuracies – insufficient detail or development – lack of logic – lack of organization – poor paragraphing – repetition – some content that does not make sense, is confusing or is not understood – some content that is inappropriate or not pertinent to the task – task requirements missing – other: _____
› *Conclusion or closing* 1 Effective 0 Ineffective 0 Missing	+ appropriate + original + useful + other: _____	– does not make sense – inappropriate or not pertinent to the task or context – incomplete – repetitive – unclear – other: _____
› *Adaptation of the text to purpose and audience (task)* 5 Entirely 3 Mostly 1 Somewhat 0 Not at all	+ well-selected content + well-adapted content + well-selected language + other: _____	– some inappropriate content – some poorly adapted content – some inappropriate language – other: _____
Total mark for Competency 3	**/20**	

Main challenges

Special cases

If you are unable to fairly evaluate the text using the tool, select one of the following descriptors and allot 6/20.

- Most or all of the text cannot be understood, despite interpretation.
- The text is incomplete or too short.
- The text is off task.

[1] If this evaluation tool is used along with a Competency 2 tool, do not evaluate "Body of the text" or "Adaptation of the text to purpose and audience," in order to avoid an overlap in evaluation, as these two elements will be addressed in the Competency 2 tool.

Using the Evaluation Tool

This generic evaluation tool is suitable for most writing tasks. It may be used with Elementary 5 or 6 students. You may adjust the level of difficulty through task choice, design, requirements and expectations.

This tool was designed for two purposes:

1) to allow teachers to collect marks on students' writing skills for the report card
2) to help teachers support student learning by providing specific feedback

The left-hand column is used to assess the texts and provide marks. In the right-hand column, you may provide specific feedback that will allow students to have a better idea of what they are doing well (+ sign) and what they still need to work on (– sign), and enable you to base your assessment on observable elements.

For each section of the evaluation tool, first determine which descriptor best represents the student's text, and circle the corresponding mark. Next, in the right-hand column, circle the elements that were particularly strong and those that were the most problematic. The goal is to identify which elements stood out and which should be tended to, not to catch each mistake or weakness. Finally, add up the marks in the left-hand column to obtain the final result for the task.

Notes on the Descriptors

› *Comprehension of the text by an anglophone*

You must read the text in its entirety as if you were an anglophone with little or no knowledge of French or the task.

Easily understood – You do not have to infer to understand the text.

Despite errors, if any – Errors, if any, do not affect the comprehension of the text.

Some interpretation – You must infer to understand parts of the text but most of the text requires no interpretation.

Considerable interpretation – You must make a substantial effort to understand several parts, or a significant portion of, the text.

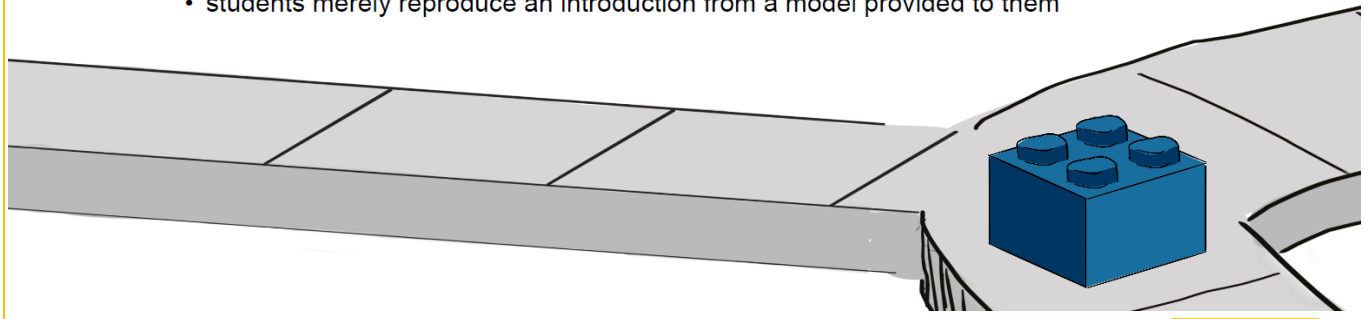
Parts of the text are not understood despite interpretation – Even though you try to infer meaning, part of the text remains unclear.

› *Introduction or introductory sentence*

Depending on the form of text that students are required to write, the introduction may simply consist of an introductory sentence (e.g. *I'm writing to propose a new activity for the school* or *Once upon a time there lived a little girl*).

Do not use this section (and adjust the total marks) if:

- the text does not call for any introduction or introductory sentence (e.g. poster)
- students merely reproduce an introduction from a model provided to them



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› *Body of the text*

No matter what form of text students are required to write, the body of the text must meet certain requirements: the content must be relevant to the task and sufficiently developed; ideas must be clear and grouped in a logical manner so the reader can easily follow them; information must be accurate, etc. To determine the degree of effectiveness, refer to the task and the set requirements. Refer to the sidebar if the task involves Competency 2.

Note about integrated tasks

If the task that students carry out involves Competency 2, *To reinvest understanding of written and oral texts*, two sections of the tool will not be used in order to avoid an overlap in evaluation: "Body of the text" and "Purpose and audience." These sections will be addressed in the Competency 2 tool.

› *Conclusion or closing*

Depending on the form of text that students are required to write, the conclusion may simply consist of a brief sentence that appropriately brings the text to a close (e.g. *I hope this information will be useful* or *They lived happily ever after*).

Do not use this section (and adjust the total marks) if:

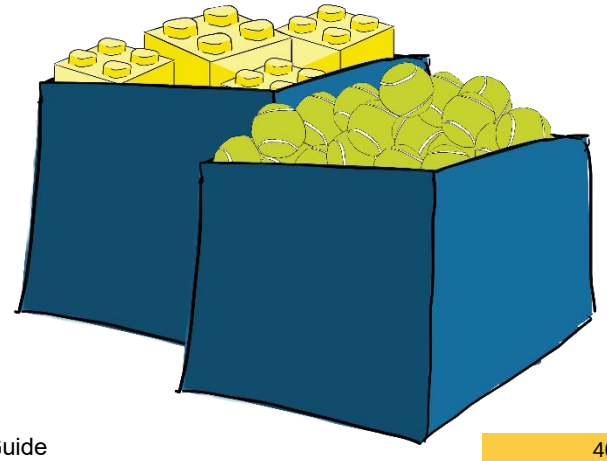
- the text does not call for any conclusion or closing (e.g. poster)
- students merely reproduce a conclusion or a closing from a model provided to them

› *Adaptation of the text to purpose and audience*

All texts are written for a purpose and a target audience. The purpose can be basic (e.g. to remind someone of an upcoming event) or more complex (e.g. to convince someone to do something). The target audience can be a single person, a group or the public at large.

You can determine whether or not a text was written in light of the purpose and audience by asking yourself a few questions. For example:

- Does the text accomplish what it was supposed to accomplish? For example, if the student was meant to explain a concept, was the concept explained well so that the reader will easily understand?
- Is the language used appropriate to the purpose and audience? For example, are words too technical for the target audience? Is slang used in a formal text?
- Is necessary background provided (if applicable)? For example, does the audience need to know certain facts about the topic to understand the text?
- Is there too much irrelevant or extraneous information, thus confusing the reader?
- Is information detailed enough for the audience to understand? For example, if a decision is presented in the text, is it explained? Are opinions supported?
- Is the information too specialized or technical for the reader, hindering his or her comprehension?
- Is the information organized in a way that the reader can easily follow and understand?



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