Teamwork, Training and Technology for development of Key Competencies

Teachers' Guidelines Book

2011

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Contents

Leaf measuring

Objective: To teach students the principle of modification variability and statistics

Description: Students measure their height and the length of 10 or 20 leaves from the same tree and make statistical charts.

Skills and key competences:
- General knowledge about modification variability
- General knowledge about statistics
- Communication in the mother tongue
- Communication in foreign languages /can be easily translated to foreign language/
- Maths, science & technology
- Digital competence
- Learning to learn
- Entrepreneurship

Management: this activity works best with students working in team of 2 or 3 people.
Materials and tools:
- Leaves from trees
- Rulers
- Paper
- Pens
- Yardsticks

Procedure:
Step 1: Students are shown a short presentation, which introduces the main terms for modification variability and gives a basic information about it.

Step 2: The task is to define the limits of the students' height. The students measure each other's height and put the results in a table and make graphics. They have to define the average value and to indicate the lowest and highest value. The teacher guides the students through this step.

Discussion: Which are the factors that have influence on the height of a person?

Step 3: For this step students can work in group of 2 or 3 people or independently. Each group gathers 20 leaves from the same tree and measures the length of every leaf. They put the results in a table and make graphics. They have to define the average value and to indicate the lowest and highest value.

Discussion: Which are the factors that have influence on the length of the leaves?

Additional task: students may measure the width of the leaves.

Step 4: Discussion

What does heredity mean?
Do people inherit their height?
What about their skin colour?
What about the shape of the leaves on trees?
Do these change? Permanently or temporarily?

Stable constructions

Aims: Developing the ability of logical thinking, team work, time and resource management, as well as teaching the main two and three dimensional objects. Practical example for length rations between diagonals, heights and sides of different figures.

Description: Students have limited time and resources to build a stable construction, which can resist the pressure of a certain object (a small box full of pebbles, or mobile phone for example) placed on the top of the construction. A successful construction is one which is 1 stable, 2 the highest one, 3 the most originally engineered one.

Skills and key competences:
- Communication in the mother tongue
- Communication in foreign language (the activity can be easily translated)
- Maths, science & technology
- Learning to learn
- Entrepreneurship

Management: This activity works best with students working in groups of 2 or 3 people.

Materials:
- Plasticine
- Spaghetti sticks
- A measuring line or tape
- Box with pebbles (or other object to be placed on the top of the construction)
- Boards for the students to work on

Procedure:
Step 1: The activity starts with a short discussion about geometric figures, which is conformed to the students' age. The discussion includes comments on different buildings throughout the world, which stood the test of time – Which? Why?

Step 2: The teams are given certain and even amount/quantity of the materials – plasticine and spaghetti sticks. The teacher assigns the time for work and can help the students with leading/guiding questions.

Step 3: When all constructions are ready, their stability is tested with the object used for weight. The teacher measures the height of the constructions which prove to be stable (from the foundations to the point where the object had been put). The construction which is stable and the highest wins.

Step 4: Discussion – why some of the constructions fall apart and others don't? What makes a construction stable? Why the materials weren't enough for some teams?

Soil erosion

Objective: To teach students the different types of soil terrain, the principle of soil erosion and the influence of people over these.

Description: Students gather soil, arrange it in preset way, pour water over it, observe the process and make conclusion

Skills and key competences:
- General knowledge about different types of soils
- General knowledge about soil erosion
- Communication in the mother tongue
- Communication in foreign languages /can be easily translated to foreign language/
- Maths, science & technology
- Learning to learn
- Entrepreneurship

Management: this activity works best with students working in groups of 3 to 5 people.

Materials and tools:
- Soil
- Cartons
- Moss, pebbles, little sticks
- Pens
- Paper
- Coffeemaker filters
- Large measuring cups
- Water
- Chronometer

Procedure:
Step 1: Students gather soil from the nearest place possible. They return to the class room and arrange the soil in the prepared cartons (students don't have to fill up the whole cartons, just 10 – 20 centimeters). Cartons should have holes at one of their sides, at the bottom (image 1). There are three different cartons:
The first one is filled with the soil randomly

The second one is filled with soil mixed with pebbles and sticks and then the mixture is covered with moss
The third one is made as a terrain with terraces (staircase like, the lowest terrace is the closest to the hole in the carton)

Step 2: When everyone is ready, students' next task is to place the cartons at an angle, so that the side with the hole is lower than its opposite. Now students have to prepare for the next step – they have to put a coffee maker filter over a measuring cup(every group should have at least one measuring cup to store all the water) , prepare the chronometers and the water.
Step 3: Every group starts pouring water in their cartons. The quantity of the water depends on how much soil they've put in the cartons. Pouring goes slowly and evenly.The measuring cups with filters are placed underneath the hole and when the water starts to flow from it, students start their chronometers. They stop them when the water stops flowing from the hole.
Step 4: All the data is put in a table – how much water we have in each cup, how much time did it take to drain the water, do you have sludge on the filters. Students compare data.

Step 5: Discussion:
How man influences nature?
Is the influence positive or negative?
What is soil erosion, how it works?

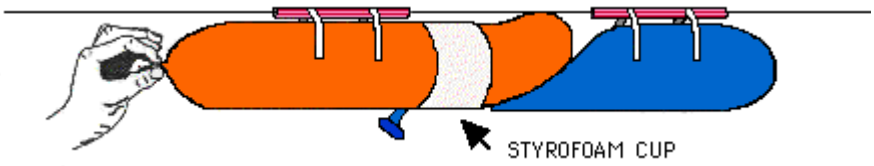
Baloon staging

Title of the activity / method	**Project Based Learning Through Balloon Staging Activity**
Target groups	Participants: 12-15 / 6,7,8,9 grades
Aims	To apply Project Based Learning methodology through Balloon Staging Activity.
Key competencies	• Communication in mother tongue • Communication in foreign languages • Math, Science & Technology • Learning to Learn • Entrepreneurship
Duration	2 hours
Place	Any classroom
Short description of the activity	Students' mission is to work within a group in order to design, construct and fly their Staging Balloon rockets. They have limited materials and time to design their staging balloons. They have to use material, knowledge, creativity and time wisely. Staging Rocket Project Phases; • Rocket history • Staging balloon rocket design and construction phase • Staging Balloon launch
Evaluation	The rocket project is graded, and a rocket award is given at the end of the project.
Materials / Resources	Material; two long party balloons (round balloon will not work), Nylon monofilament fishing line (any weight), two plastic straws (milkshake size, non-bendable), Styrofoam cup, Masking tape, Scissors http://www.grc.nasa.gov/WWW/k-12/TRC/Rockets/balloon_staging.html
School subjects/areas	Project Based Learning method can be used for all disciplines, especially science, mathematics and technology.

Short theoretical background (if applicable)	Project Based Learning model is recommended. It focuses on the central concepts and principles of a discipline, involves students in problem-solving and other meaningful tasks, allows students to work autonomously and to construct and become knowledgeable through inquiry, and culminates in a realistic hands-on project.

Balloon Staging
Objective: To demonstrate how several stages of a rocket can operate in steps to propel a rocket
.
Science Standards:
Science as Inquiry
Physical Science – Position and motion of objects
Science and Technology – Abilities of technological design

Science Process Skills:
Observing
Communicating
Inferring
Making Models
Defining Operationally
Description: Two inflated balloons are joined in a way simulate a multistage rocket launch as they slide along a fishing line on the thrust produced by escaping air.



Materials and Tools:

- 2 long party balloons (round balloon will not work)

- Nylon monofilament fishing line (any weight)
- 2 Plastic straws (milkshake size, non-bendable)
- Styrofoam cup
- Masking tape

- Scissors
- Pump
- Measuring tape

Procedure:

- Thread the fishing line through the two straws. Stretch the fishing line snugly across a room and secure its ends. Make sure the line is just high enough for people to pass safely underneath.
- Cut the cup in half so that the lip of the cup forms a continuous ring.
- Loosen the balloons by preinflating them. Inflate the first balloon about 3/4 full of air and squeeze its nozzle tight. Pull the nozzle through the ring. While someone assists you, inflate the second balloon. The front end of the second balloon should extend through the ring a short distance. As the second balloon inflates it will press against the nozzle of the first balloon and take over the job of holding it shut. It may take a bit of practice to achieve this.
- Take the balloons to one end of the fishing line and tape each balloon to a straw. The balloons should be pointed along the length of the fishing line.
- If you wish, do a rocket countdown and release the second balloon you inflated. The escaping gas will propel both balloons along the fishing line. When the first balloon released runs out of air, it will release the other balloon to continue the trip.
- Teachers can evaluate the teams' performance according to Grading Sheet.

Conclusion

Travel into outer space takes enormous amounts of energy. Much of that energy is used to lift rocket propellants that will be used for later phases of the rocket's flight. To eliminate the technological problems and cost of building giant one-piece rockets to reach outer space like all space fairing nations of the world have chosen to use a rocket technique that was invented by 16thcentury fireworks maker Johann Schmidlap. To reach higher altitudes with his aerial displays, Schmidlap attached smaller rockets to the top of larger ones. When the larger rockets were exhausted, the smaller rocket climbed to even higher altitudes. Schmidlap called his invention a "step rocket."

NASA utilizes Schmidlap's invention through "multi staging." A large first stage rocket carries the smaller upper stages for the first minute or two of flight. When the first stage is exhausted, it is released to return to the Earth. In doing so, the upper stages are much more efficient and are able to reach much higher attitudes than they would have been able to do simply because

they do not have to carry the expired engines and empty propellant tanks that make up the first stage. Space rockets are often designed with three or four stages that each fire in turn to send a payload into orbit.

BALLOON STAGING AWARD

is presented to

Name.....

Date.....

This award is in recognition of your team's exemplary balloon staging. Working together, your team succeeded in applying

BALLON STAGING GRADING SHEET

Name of the team: _____

Team Members : _____

_____

Grading Team

	Poor 1	**Good 2**	**Perfect 3**
Communication			
Math			
Science			
Teamwork			
Timing			

TOTAL 0

Grading Staging Rocket

	Number of Test		
	1	2	3
Distance of Balloon Rocket			

TOTAL 0

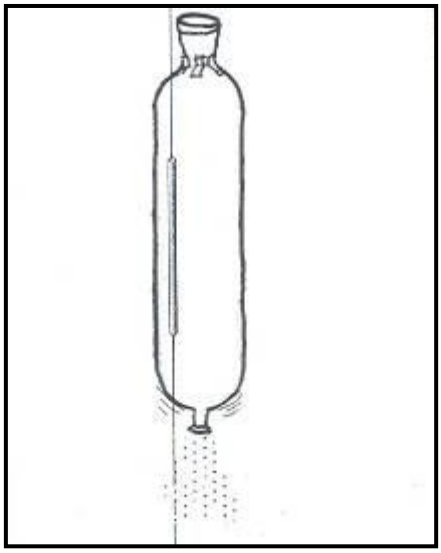
Rocket transportation

Title of the activity / method	Project Based Learning Through Rocket Transportation Activity
Target groups	Participants: 12-15 / 6,7,8,9 grades
Aims	To apply Project Based Learning methodology through Rocket Transportation Activity.
Key competencies	• Communication in mother tongue • Communication in foreign languages • Math, Science & Technology • Learning to Learn • Entrepreneurship
Duration	2 hours
Place	Any classroom
Short description of the activity	Students' mission is to work within a group in order to design and construct a balloon rocket and solve how to lift a load using a balloon rocket. Students construct a rocket out of a balloon and use it to carry a paper clip payload. They have limited time and materials to produce efficient rocket balloon and cargo system to carry loads. They have to use knowledge, creativity and time wisely. Transportation Rocket Activity Phases; • Rocket history • Balloon Rocket and cargo bay design and construction phase • Balloon Rocket launch
Evaluation	The balloon transportation project is graded and a rocket award is given at the end of the project.
Material / Resources	Material: Large, long balloons (several per group), Fishing line, Straws, Small paper cups, Paper clips, Tape, Clothes pins, Scales http://er.jsc.nasa.gov/seh/Rocket_Transportation.pdf
School subjects/areas	Project Based Learning method can be used for all disciplines, especially science, mathematics and technology.

Short theoretical background (if applicable)	Project Based Learning model is recommended. It focuses on the central concepts and principles of a discipline, involves students in problem-solving investigations and other meaningful tasks, allows students to work autonomously and become knowledgeable to construct their own knowledge through inquiry, and culminates in a realistic hands-on project.

Objective:To problem solve ways to lift a load using a balloon rocket.

Description: Students construct a rocket out of a balloon and use it to carry a paper clip payload.



Science Standards:
Science as Inquiry
Physical Science - Position and motion of objects
Science and Technology - Abilities of technological design

Science Process Skills:
Observing
Communicating
Measuring
Collecting Data
Inferring
Predicting
Making Models
Defining Operationally

Mathematics Standards:
Problem Solving
Communication
Reasoning
Connections
Estimation
Measurement

Management:
This activity works best with students working in teams of three or four. It will take approximately one hour to complete. The activity focuses on the scientific processes of experimentation.

Background Information:
The mass of a rocket can make the difference between a successful flight and a rocket that just sits on the launch pad. As a basic principle of rocket

flight, a rocket will leave the ground when the engine produces a thrust that is greater than the total mass of the vehicle. Large rockets, able to carry a spacecraft into space, have serious weight problems. To reach space and proper orbital velocities, a great deal of propellant is needed; therefore, the tanks, engines, and associated hardware become larger. Up to a point, bigger rockets fly farther than smaller rockets, but when they become too large their structures weigh them down too much. A solution to the problem of giant rockets weighing too much can be credited to the 16^{th} century fireworks maker John Schmidlap. Schmidlap attached small rockets to the top of big ones. When the large rockets exhausted their fuel supply the rocket casing dropped behind and the remaining rocket fired. Much higher altitudes can be achieved this way.

This technique of building a rocket is called staging. Thanks to staging, we can not only reach outer space in the Space Shuttle, but also the Moon and other planets using various spacecraft.

Materials and Tools:

- Large long balloons (Several per group)
- Fishing line
- Straws
- Small paper cups
- Paper clips
- Tape
- Clothes pins
- Scales

Procedure:

1. Attach a fishing line to the ceiling or as high on the wall as possible. Try attaching a paper clip to a fishing line and hooking it on to the light or ceiling tile braces. Make one drop with the fishing line to the floor or table top per group. Note: The line may be marked off in metric units with a marker to aid students in determining the height traveled.

2. Blow up the balloon and hold it shut with a clothes pin. You will remove the clip
before launch.

3. Use the paper cup as a payload bay to carry the weights. Attach the cup to the balloon using tape. Encourage students to think of creative locations to attach the cup to the balloon.

4. Attach the straw to the side of your rocket using the tape. Be sure the straw runs lengthwise along the balloon. This will be your guide and attachment to your fishing line.

5. Thread the fishing line through the straws. Launch is now possible simply by removing the clothes pin. NOTE: The fishing line should be taut

for the rocket to travel successfully up the line, and the clipped balloon nozzle must be untwisted before release.

6. After trying their rocket have students predict how much weight they can lift to the ceiling. Allow students to change their design in any way that might increase the rockets lifting ability between each try (e.g. adding additional balloons, changing locations of the payload bay, replacing the initial balloon as it loses some of its elasticity enabling it to maintain the same thrust, etc.)

7. Teachers can evaluate the teams' performance according to Grading Sheet.

Discussion:
1. Compare what you have learned about balloons and rockets.

2. Why is the balloon forced along the string?

Assessment:
Compare results from student launches. Have students discuss design elements that made their launch successful and ideas they think could be used to create an even more successful heavy-lift launcher.

Extensions:
Can you eliminate the paper cup from the rocket and have it still carry paper clips?

If each balloon costs one million dollars and you need to lift 100 paper clips, how much money would you need to spend? Can you think of a way to cut this cost?

Without attaching the paper cup as a payload carrier, have the students measure the distance the balloon travels along the string in a horizontal, vertical, and 45 degree angle using metric units. Discuss the differences.

Rocket
Transportation

Rocket Team _____
_____
_____

Predict how much weight your rocket can lift to the ceiling _____
(2 small paperclips = approximately 1 gram)

Test	Weight Lifted	Results of Test

1		
2		
3		
4		
5		

Based on your most successful launch:
What was the maximum amount of weight you could lift to the ceiling?

_____

Explain how you designed your rocket to lift themaximum amount of weight**.**

Sketch Your Rocket

_____
__

_____
__

_____
__

_____

_____

_____

_____

What other ways could increase the lifting capacity of your rocket?

ROCKET TRANSPORTATION AWARD

is presented to

Name.....

Date.....

This award is in recognition of your team's exemplary design for a heavy-lift launcher. Working together, your team succeeded in using the principles of motion, technological design, and experimentation to successfully build and launch

Transportation Grading Sheet

Name of the team: _____

Team Members : _____

_____

_____

Grading Team

	Poor 1	Good 2	Perfect 3
Communication			
Math			
Science			
Teamwork			
Timing			

TOTAL | 0 |

Grading Transportation Rocket

	Number of Paper Clips		
	3	4	5
Height of Balloon Rocket			

TOTAL | 0 |

Paper rocket

Title of the activity / method	Project Based Learning Through Paper Rocket Activity
Target groups	Participants: 12-15 / 6,7,8,9 grades
Aims	To apply Project Based Learning methodology through Paper Rocket Activity.
Key competencies	• Communication in mother tongue • Communication in foreign languages • Math, Science & Technology • Learning to Learn • Entrepreneurship
Duration	2 hours
Place	Any classroom
Short description of the activity	Students' mission is to work within a group in order to design, construct and fly their paper Rockets. They have limited materials and time to design their paper rockets. They have to use material, knowledge, creativity and time wisely. Paper Rocket Phases; Rocket history, Paper rocket design and construction phase Paper rocket launch
Evaluation	Discussion will be made with students to check their knowledge and exchange ideas to design better rockets.

Materials / Resources	Material; Paper, cellophane tape, Scissors, Rulers, Pencils, rocket forms (short lengths of PVC tubes of the same outer diameter as the launcher (usually 1,25cm) tube for the rockets –available in 15cm or 30cm sections at most hardware stores.) Launcher - Several commercially available versions are available, and are ideal for younger students. Homemade Industrial strength version should be teacher operated only! Hand bike pump with gage to check atmospheric pressure or electric air compressor for industrial strength launcher. Safety glasses, two long party balloons (round balloon will not work), Nylon monofilament fishing line , two plastic straws (milkshake size, non-bendable), Styrofoam cup, Masking tape, Scissors
School subjects/areas	Project Based Learning method can be used for all disciplines, especially science, mathematics and technology.
Short theoretical background (if applicable)	Project Based Learning model is recommended. It focuses on the central concepts and principles of a discipline, involves students in problem-solving and other meaningful tasks, allows students to work autonomously and to construct and become knowledgeable through inquiry, and culminates in a realistic hands-on project.

Objective: To teach students about rockets, aerodynamics trough hands on problem solving activity.

Description: Students will construct paper rockets and launch them with a commercially available foot-pump rocket launcher or an industrial strength rocket launcher built by the teacher or a select group of students (such as a science club).

Science Standards:
Science as Inquiry
Physical Science
Science and Technology

Science Process Skills:
Observing
Communicating
Measuring
Collection Data
Inferring
Predicting
Making Models

Defining Operationally

Materials and Tools:
- Paper
- Cellophane tape
- Scissors
- Rulers
- Pencils
- Rocket forms (short lengths of PVC tubes of the same outer diameter as the launcher (usually 1,25cm) tube for the rockets –available in 15cm or 30cm sections at most hardware stores.)
- Launcher - Several commercially available versions are available, and are ideal for younger students. Homemade Industrial strength version should be teacher operated only!
- Hand bike pump with gage to check atmospheric pressure or electric air compressor for industrial strength launcher
- Safety glasses

Time Frame for Paper Rocket Activities

Class-Construction of Rockets: will take from 1/2 hour to 1 hour.

Launching of Rockets: will take 1 hour for a classroom size of 27 students. It
will depend on the classroom size, the type of launcher used, and the number of
launches per student.

Optional Calculating the Altitude of the rockets: will take 1/2 hour.

Rocket Construction
Use the directions on the construction sheet for constructing the paper rockets.
Have students roll paper around the short lengths of the PCV tube. The tubes serve as forms for constructing the paper rockets. For best performance the paper should be snug on the form but able to slide easily. Make sure students firmly attach the fins and nose cone for their rockets.

Note: *Poorly attached nose cones will blow off the rocket leaving the rocket behind or allowing air to escape when trying to build pressure for launch. Rocket bodies that are made poorly made may explode into confetti while on launch pad.*

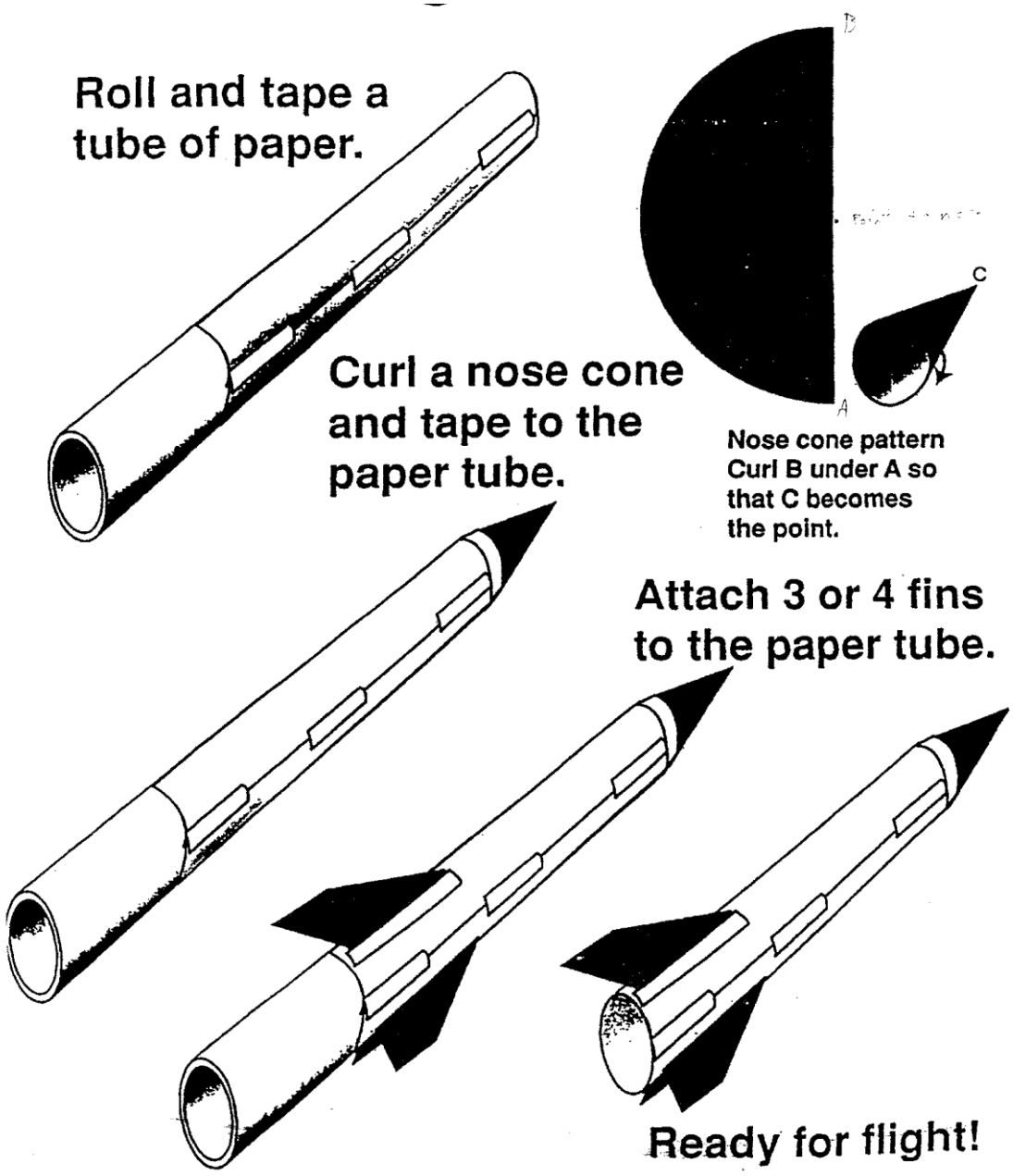
Launch Procedures
Follow the instructions for constructing paper rockets. When the rockets are ready follow these instructions for launch:

1. Select a clear area field for launch. Although the rockets are constructed of paper they can still cause injury if they strike someone.
2. Set up the launcher and orient the base so that the launch tube can point straight upward. If the wind is blowing you will want to aim the angle of the tube slightly into the wind.
3. Connect the air compressor or bike pump to the tire valve on the launcher. With the valve closed, pump the launcher up to 2.04atm of pressure. Observe how far the rocket goes and in which direction. Make adjustments to the aiming and pump the launcher to 3.04atm of pressure. Again test fire the rocket and make any final aiming adjustments.

Instructional Ideas for the Teacher:
Have a rocket design contest. Even when using the templates, every rocket will be different. Divide your students into groups and give awards for the furthest or highest flight using the same pressure and launch angle.

Explore projectile motion. Have your students determine which launch angle allows the rockets to go the maximum distance (45º). One commercial launchers may used for each group of 3-5 students or either type of launcher may be used by the entire class.

Explore variables. What makes one rocket out perform another? Do launch conditions (such as wind speed/direction and the direction of launch) matter?



4. Have a student load their rocket on the launch rod. If using industrial strength launcher and/or a high launch angle, students must then clear the launching site. Otherwise students may stand behind the launcher and away from the direction of launch

5. Perform a count down. If you will be determining how high the rocket flies, this allows the trackers know when the rocket is about to launch.

6. Let only the builder of the rocket fetch it after it lands.

Safety Rules

All launches:

- Do not lean over the launch rod at any time.
- Wear eye protection for launches.

When using industrial strength launcher:
- Do not pump the launcher up to a pressure greater than half the rate pressure of the weakest part. The PVC pipes and the valve come with pressure ratings. If the lowest rating is 10.2atm, do not pressurize the launcher to greater than 5.1atm. This provides a significant safety margin.
- Be careful in handling the launcher. PVC can crack if dropped or struck with sufficient force. Inspect the launcher before use. Discard a launcher that shows signs of cracking.

Tip: Some teachers have reported better flight performance with low-pressure launches (including with the foot-powered commercial launchers) than with high-pressure launches. Aerodynamic drag on the rocket increases with velocity. At higher initial velocities, rocket fins may be distorted leading to even greater drag and diminished performance.

How could students test this theory?

Name _____ Date _____ Period _____

Paper Rocket Lab
Students will construct paper rockets to be launched with an air pressure rocket launcher.

Materials
- Paper (copy paper size 21 X 29)
- Cellophane tape
- Scissors
- Rulers
- Pencils

- Rocket forms (short length of 1,25cm PVC tubes)
- Colored markers (optional)
- Safety glasses for the launch

Question: How will rocket performance differ between rockets that fit tightly or loosely on the launcher?

Write your hypothesis: _____
_____
_____

Procedure
Step 1: Using the Rocket form begin to wrap rocket paper around the tubing. Paper should be snug on the form but able to slide easily off the form.

Step 2: With cellophane tape, tape your paper rocket form.

Step 3: (a) Make a nose cone by drawing a 7,62 circle and cutting it out or you may use a pattern provided by your teacher.
(b) From outside of circle cut to middle of circle and stop.
(c) Curl B under A so that it becomes the point. Then tape closed from the under part of the curl. Set aside.
Step 4: Cut out using rocket paper 3 fins that may then be taped to the lower part of paper rocket. Make sure you firmly attach fins!
Step 5: Tape nose cone to top of paper rocket. Make sure you firmly attach the nose cone! Name and decorate if time allows.

Step 6: (Optional) Name and decorate your rocket.

Lab Questions

1. Did all the rockets perform the same when launched?
2. To stabilize the rocket, fins were applied. How many are needed to stabilize the rocket?
3. Do the sizes of fins matter?
4. Why does wind affect paper rocket performance?
5. How can weight affect the distance a rocket will fly? (Look at the various rockets made in your classroom, was specific materials used exactly the same.)
6. What would happen if you placed the fins near the nose-cone of the rocket?
7. Write a short lab report describing how your rocket flew. Then draw pictures of your rocket before launching, and after launching.

Name_____ Date_____
Period_____

Rocket Report Using the Scientific Method

Building and Launching a Rocket

Using the scientific method build a paper rocket then launches it outside under the direction of your science teacher.

1. Problem: (Question format)
2. Hypothesis: (Your educated guess, using prior knowledge on the subject from Radio, TV, Newspaper, Books, Internet, Class discussions.)
3. Experiment: (Carrying out your experiment using "Steps" to show the order in which you started and completed your experiment.)
4. Observations: (What you observed as following your steps. How the rocket was made and how it performed.)
5. Data: (Collecting information about your rocket from your observations. You may have quantitative and qualitative data here also.)
6. Conclusion: (What were your findings from building to launching your rocket? Did it answer the Problem? How did it follow your hypothesis?)

Water rocket

Title of the activity / method	**Project Based Learning Through Water Rocket Activity**
Target groups	Participants: 12-15 / 6,7,8,9 grades
Aims	To apply Project Based Learning methodology through Water Rocket Activity.
Key competencies	• Communication in mother tongue • Communication in foreign languages • Math, Science & Technology • Digital competence • Learning to Learn • Entrepreneurship
Duration	7 hours
Place	Any classroom
Short description of the activity	Students' mission is to work within a group in order to design construct and fly their Water rocket. They will have a budget of 1 million dollars. They have to use money, time, knowledge, and creativity wisely. Water Rocket Project phases; • Rocket history and rocket demo • Water rocket design and construction phase • Water rocket launch
Evaluation	The rocket project is graded, and a rocket award is given at the end of the project.
Materials / Resources	Material; Rocket packet, plastic bottles, aluminium cans, cardboards, poster boards, sheets of construction paper, duck tape, masking tape, low temperature hot glue guns, glue sticks (for hot glue guns), roll of kite string or similar, package of modelling clay, spray paint, plastic bags, markers, Ziploc bag, tough scissors, flexible rulers, compasses, glue, kitchen timers with bell. Water rocket launcher. http://exploration.grc.nasa.gov/education/rocket/BottleRocket/about.htm
School subjects/areas	Project Based Learning method can be used for all disciplines, especially science, mathematics and technology.

Short theoretical background (if applicable)	Project Based Learning model is recommended. It focuses on the central concepts and principles of a discipline, involves students in problem-solving investigations and other meaningful tasks, allows students to work autonomously to construct their own knowledge through inquiry, and culminates in a realistic hands-on project.

OUTLINE:
The total time for the activity: 7 hours
Rocket History and Rocket Demo (30 minutes)

Water Rocket Design and Construction Phase (total 5.5 hours)
Rocket 1: 1.5 hours
Rocket 2: 2 hours
Rocket 3: 2 hours

Water Rocket Launch (1 hour)

OBJECTIVE:
To apply Project Based Learning methodology through Water Rocket Activity

Rocket History and Rocket Demo (30 minutes)

Objectives: Inform the students about the history of and principles behind rocketry.

1. EXPLAIN: What is a rocket, types of rockets, rocket design, why rockets are used
2. DISCUSS: The principles of how a rocket works

Science Standards:
Science as Inquiry
Abilities necessary to do scientific inquiry
Physical Science
Motions and Forces
Science and Technology
Abilities of technological design
Understanding about science and technology
History and Nature of Science
Science as a human endeavor
Nature of science

Science Process Skills:
- Observing
- Communicating
- Predicting

Materials and Tools:
- Laptop
- Projection machine

Outline:
INTRODUCTION (2 minutes)
POWER POINT PRESENTATION (25 minutes)
CONCLUSION (3 minutes)

Procedures:
Take the students where you can show the power point presentation about rockets. Through the slides explain the meaning of rocketry, what rockets are, rocket fuels, types of fuels, principles of motion, how rockets works, rocket designs
Water Rocket Design and Construction Phase (5.5 hours)
Rocket 1 (1.5 hours)

Objectives: As the first of three rocket building sessions, Rocket 1 serves as an introduction to the rocket building process. Upon completion of this activity the students will be able to . . .

1. EXPLAIN: the goal and basic processes needed to complete the rocket project.
2. COMPLETE: the first three pages of the rocket packet.

Science Standards:
- Science as Inquiry
- Abilities necessary to do scientific inquiry
- Physical Science
- Motions and Forces
- Science and Technology
- Abilities of technological design
- Understanding about science and technology
- History and Nature of Science
- Science as a human endeavor
- Nature of science

Science Process Skills:
- Observing
- Communicating
- Predicting

Materials and Tools:

Quantity	Item
4	Water Rocket Packets
1	Example of Rocket Silhouette
1	Example of a finished rocket
4	Example of a finished rocket packet in binders
1	Example of large & small poster board
1	Example of large & small cardboard

Outline:
INTRODUCTION (5 minutes)
WATER ROCKET PACKET DESCRIPTION (45 minutes)
WATER ROCKET PACKET WORK (30 minutes)
CONCLUSION (10 minutes)

Procedures:

INTRODUCTION (5 minutes)
As the students enter ask them to sit in four groups of four. Begin the session by getting the groups excited about the rocket project. One way to do this is to hold up a two-liter bottle and ask the students what they could make out of it. Use their answers to lead into a description of the rocket project.

In the project, students within each group will design, build, test, and launch a bottle rocket. Show the students an example of a finished bottle rocket. Explain to the students that on launch day water will be added to the bottles and they will be attached to a pump. Air will be pumped into the rockets, and when released the rockets should soar into the air. The rocket, when launched, should be stable. This means it should not flip uncontrollably.

As part of this project, each group will have a budget of one million dollars with which to purchase materials for constructing their rocket. They will project their total cost for the rocket, as well as keep a continuous record of expenditures once they begin construction. It is best to be as close as possible to the projected figure once the rocket is complete. At the end of the activity the best project will win an award.
The rockets will be judged not only on how they fly, but also on appearance and how they were constructed. This session is devoted to planning; the groups will begin building during the next session. After this

session questions will cost a rocket company $3000 dollars, so the campers will want to pay close attention and ask questions.

WATER ROCKET PACKET DESCRIPTION (45 minutes)
Distribute one blank rocket packet and one completed rocket packet to each group. Every two students can share one of these as they listen to a page-by-page description of the rocket project.

1. Journal Cover: The first page is blank. This is so that the students can design
their own creative journal cover. When the entire packet is scored, this will be the first page the judges see.

2. Project X-35 Rocket: This outlines the phases of the project and what the students are suppose to do in each. If students forget what they are supposed to be working on during any part of the project, they can refer to this page as well as the checklist page. The students should notice that the first session is an organizational phase, the second is for construction, the third is for testing and finishing touches and the fourth is the launch day.

3. Checklist: This page not only lists all of the steps that need to be completed, but the group will also use it to determine who is responsible for each step. At the end of this explanation the students should write the name of a group member on each line. This will be the person that supervises that step; it will not be the only person working on that part of the project.

4. Certificate of Assumed Name: This paperwork sets up the rocket company for each group. Each group determines their own state, project number and the name of the business. Each member of the group should list his name after question #2 and give himself a title. For instance, Sally may decide that she will be the "Vice President of Finance" and George may be "Dictator for Life of Fin Construction." Notice that there is a $25 filing fee for this form; this will be the first expense on the group's budget projection sheet.

5. Materials and Price List: Explain to the students that they have a budget of one million dollars. This page lists the amount of money they will spend if they choose to use any of the items listed. Either now, or later when the team is working on this sheet, discuss each item. First, each team can only buy one bottle, large or small. Cardboard or poster boards are available for nose cones, fins, rocket tests or other creative uses. Show the students examples of the small and large sizes of each. Tape and Elmer's glue are available to attach items. Notice that the hot glue is charged by 5-minute sessions. String is needed in the testing phase. Clay can be used for weight or any other creative use. Spray paint and markers are available for decoration. The markers can write on plastic. The spray paint charge is per 5 minutes (This is not what is

indicated on the worksheet so emphasize this). Cans and Plastic Bags are purely optional. Every group should pay for rocket fuel and the launch charge. Questions after this session cost $3000 per question.

6. Budget Projection Sheet: Here the students should write every item they expect to use during construction. Groups that stay on budget receive higher scores, so it is important to list every item. The groups should add up the total cost during this session and then this sheet cannot be changed.

7. Balance Sheet: This works like a checkbook. The campers should record every expense and subtract it from the total. This will be compared to the Budget Projection Sheet when the project is scored. It is best to be as close to the projected total as possible.

8. Checks: Don't cut these out! Once a check is written and the group needs the item, the person in charge of checks may go to the teacher. That person will initial the check and make sure the group gets the item. Stress that the group should only write checks for the items they need immediately. This will prevent the groups from asking for all their supplies at once.

9. Measurement Sheet: On this page the group will record the appropriate measurements of the rocket for use when making the scale drawing. Like scientists the students should measure in centimeters. Practice by measuring the length of the rocket and ask the students to remember that number. Also ask the students which objects would have a measurement for diameter and circumference and how the groups might find these values.

10. Scale Drawing: The group should draw their rocket on this page with each square equaling 2 centimeters. Practice by asking the students how many squares tall the rocket they just measured would be on this sheet.

11. Rocket Stability Determination: This and the next page explain how to conduct three tests on the rocket. These are the most difficult concepts for the students, so encourage the students to take notes in their packet concerning the following tests:

Find the center of mass: This line on the rocket represents an average of the mass of the entire rocket. Demonstrate how to find this point by tying a string around the model rocket. Adjust the string so that the rocket will balance parallel to the floor. This is the center of mass; use the ruler to measure where this line is located.

Conduct the swing test: Spin the sample rocket in a circle using the attached string. A well-designed rocket will spin with the nose cone facing forward without wobbling.

Find the center of pressure: This line represents an average of the pressure exerted on a rocket during its flight. A simple way to this is to

trace and cut out a cardboard silhouette of the rocket. Show the example of this, and show them how, by balancing this on a ruler, they can estimate the location of the center of pressure.

The students should record the center of mass and the center of pressure on their scale drawing. The center of mass should be close to the nose cone and the center of pressure should be close to the fins. After the three tests the students may wish to make modifications, so the groups should not permanently attach their nose cones until the tests are complete. If the students wish to know how to fix a problem or forget how to complete the tests, these two pages of the rocket packet explain it all.

12. Flight Day Log Sheet: The students will complete this on the day of launch.

13. Grade Sheet: Point this out to the students to show that the rocket will be graded on a variety of criteria, not just on its flight or appearance.

WATER ROCKET PACKET WORK (30 minutes)
Answer any questions and encourage the groups to continue asking questions for the remainder of the session.

The students should be able to finish the Checklist Page (3), the Certificate of Assumed Name (4) and the Budget Projection Sheet (6). Have each group begin with the checklist page. Encourage the students to divide the duties equally and make sure each student's name appears 3-5 times on the page. After a group finishes a page check their work and ask them to continue to the next. Before working on the Budget Projection Sheet encourage the students to discuss their ideas for the rocket's design so that the group can plan accordingly. Throughout the activity, rotate to each group, keep the students on task and help when needed. If a group finishes early ask them to begin working on their creative journal cover.

CONCLUSION (10 minutes)
Remind the groups that questions after this session will come out of their budget, so they should ask any remaining questions at this point. Collect the rocket packets and keep these in the team-book. After answering these, wish the groups luck and conclude.

Rocket 2 (2 hours) and Rocket 3 (2 hours)

Objectives: These two, two-hour rocket sessions are devoted to construction. Upon completion of this activity the students will be able to . . .

LAUNCH: a completed rocket
DISCUSS: the design process including the initial design, construction, testing and revisions.
EXPLAIN: the use of budgets.

Rocket 2 Goals
- Keep accurate balance sheet.
- Write checks to purchase materials.
- Construct a rocket.
- Record measurements

Rocket 3 Goals
- Make scale drawing of rocket.
- Continue to keep accurate balance sheet.
- Conduct stability test that includes finding the center mass and center of pressure.
- Conduct a swing test and record results.
- Make any modeling corrections.

Science Standards:
- Science as Inquiry
- Abilities necessary to do scientific inquiry
- Science and Technology
- Abilities of technological design
- Understanding about science and technology
- History and Nature of Science
- Science as a human endeavor
- Nature of science

Science Process Skills:
- Observing
- Communicating
- Measuring
- Collecting Data
- Predicting
- Making Models
- Defining Operationally

Materials and Tools:

Quantity	Item
4	Water Rocket Packets (from previous session)
4	2 L bottles
4	1 L bottles
4-8	Aluminum cans
4	Large cardboard pieces (approx. 56cmx36cm)
4	Small cardboard pieces (approx. 28cmx36cm)
4	Large poster board pieces (approx. 56cmx36cm)
4	Large Poster board pieces (approx. 28cmx36cm)

8	Sheets of construction paper
2	Roll duct tape
2	Roll masking tape
2	Low temperature hot glue guns
10-20	Glue sticks (for hot glue guns)
1	Roll of kite string or similar
1	Package of modeling clay
5-10	Spray Paint – multiple colors
4	Plastic bags
4	Sets Studio Basic Permanent Markers; each in Ziploc Bag
4-6	Pairs of durable, tough scissors
4-6	Flexible rulers
4	Compasses
2	School Glue
2	Kitchen timers with bell

Outline:
INTRODUCTION (5 minutes)
CONSTRUCTION (105 minutes)
CLEAN-UP (10 minutes)

Procedures:

PREPARATION
Check that all supplies are available prior to each session.

INTRODUCTION (5 minutes)
Ask the students to separate into their rocket groups as they enter. Begin by reminding the students about the rocket project and building a little excitement. For each of the two rocket-building sessions set the following goals for each group. The rocket must be ready to launch at the end of Rocket 3.

After reviewing the goals for a particular session, tell the campers that they can obtain materials by presenting a completed check. Also add any practical advice, and allow the teams to begin work.

CONSTRUCTION (105 minutes)
As the students work, provide supplies and circulate to each group. When the students obtain a bottle instruct them to test it on the launcher to ensure that it will fit; it may be wise to have the students do this again after they add their fins. Keep the students on task, but be careful when answering questions. If the students have any questions about rocket design or the topics covered in Rocket 1, ask them to write a check to you for $3000 before answering. This money should be deducted on their balance sheet.

Keep the students on task. Encourage students to work on a separate section of the project like the creative journal cover or decorations for the rocket.
Be certain to watch the students when they are using the spray paint. This should only be done in the designated spot outdoors and in facemasks should be worn during use.

CLEAN UP (10 minutes)
Throughout the session announce how much time is left before clean up. Stow all supplies and throw away any rubbish.

Water Rocket Launch (1 hour)

Objectives: Upon completion of this activity the trainees will be able to . . .
DISCUSS: the performance of their rocket design.
EXPLAIN: how outside factors such as weather may affect a launch.

Science Standards:
- Science as Inquiry
- Abilities necessary to do scientific inquiry
- Science and Technology
- Abilities of technological design
- Understanding about science and technology
- History and Nature of Science
- Science as a human endeavor
- Nature of science

Science Process Skills:
- Observing
- Communicating
- Measuring
- Collecting Data
- Predicting
- Defining Operationally

Materials:

Quantity	**Item**
1/group	Rocket Packets (from previous phase)
1/group	Completed Rockets
3/group	2L bottles filled with water
1	Water Rocket Launcher
1	Roll of Masking Tape

Outline:
INTRODUCTION (5 minutes)
DRY TEST (25 minutes)
LAUNCH (25 minutes)
CLEAN UP (5 minutes)

Procedures:

PREPARATION

Set up the rocket launcher and collect the water before the session. Allow the students to briefly repair their rockets if needed. Check the temperature and wind conditions if possible to report to the trainees at the launch site.

INTRODUCTION (5 minutes)

As the trainees reach the launch site ask the groups to find a comfortable spot to meet. Each group should work on the beginning of their Flight Day Log Sheet. Report the weather to the trainees for the appropriate blanks on the sheet, and answer any other questions the groups have. Also ask the students why scientists might be interested in this information.

DRY TEST (25 minutes)

Explain the launch system to the students. Allow each of the groups to load and launch their rockets without water. The best way to do this is to allow one students to pump and the other to pull the cord. Ask all of the remaining students to stand at a safe distance. After each recovery offer the students the masking tape and allow them to make any repairs or alterations.

LAUNCH (25 minutes)

Allow the students to launch their rockets again with water. The rockets launch best when less than half full, but allow the students to determine the exact amount of water to add. Remind the students that some of the water may be lost when the rocket is loaded onto the pad.

Ask the students on each rocket team that were not involved with the first launch to either pump or pull the cord for the second launch. Launch each rocket

and ask the students to complete the final section of their Flight Day Log Sheet. Encourage the students to consider how changes to their design might improve the rocket's flight.

CONCLUSION (5 minutes)

Gather the students together and ask them if their rockets launched as they suspected. Collect the rocket packets and score each group on teamwork, rocket appearance and rocket launch performance. Keep the rocket packets for further scoring.

WATER
ROCKET PACKET

PROJECT X-35 ROCKET CHECKLIST

Phase 1 Rocket design
Facilitator: _____ (all of group should be involved)

Phase 1 Budget projection sheet
Written by: _____

Phase 1-2 Creative journal cover
Designed by: _____

Phase 2-3 Checks and balance sheet: Accountants are in charge of writing checks,
purchasing materials, and completing the balance sheet.
(2 people)
1._____
2._____

Phase 2 Bottle rocket constructions
Constructed by: _____

Phase 2 Nose cone constructions- (Do not permanently attach nose cone until endof phase 2.)
Constructed by: _____

Phase 2 Fin construction
Constructed by: _____

Phase 2 Complete measurement sheet
Fins measured by: _____

Nose cone measured by: _____

Bottle measured by: _____

Phase 3 Scale drawing -You only need the measurement sheet and grid paper to
complete this.
Drawing completed by: _____

Phase 3 Silhouette
Cut out by: _____

Phase 3 Stability test (find center of pressure and center of mass)

Conducted by: _____

Phase 3 Swing test
Conducted by: _____
Phase 3 Any modeling revisions
Launch Flight day log sheet
Completed by: _____

State of _____

Certificate of Assumed Name

All Information on this form is public information.
Please type or print legibly in black ink.

Project Number _____

1. State the exact assumed name under which the business is or will be conducted:

_____

2. List the name and title of all persons conducting business under the above assumed name:

_____

_____

_____

_____

Today's Date _____ , 20____ Class Hour _____

Filling Fee: a $25 fee must accompany this form.

Project X-35 Rocket

Phase I:
1) Understand project requirements and expectations
2) Complete certificate of assumed name in your journal packet.
3) On rocket checklist, fill in names.
4) Complete budget projection sheet.

Phase II:
1) Complete journal cover.
2) Start rocket construction. Everyone on your team should be busy. Checks have to bewritten to purchase items. Someone needs to keep up with the balance sheet. Nosecone, fin construction, and bottle construction can take place at the same time. Yourteam should be pretty much finished with your rocket by the end of Phase I.
3) Complete measurement sheet in your journal located in your journal packet.

Phase III:
1) Make scale drawing of rocket. You only need the completed measurement sheet andgrid paper to complete this.
2) Make silhouette.
3) Find and mark center of mass. (Stability test)
4) Find and mark center of pressure (stability test)
5) Make any modeling corrections
6) Complete pre-launch analysis sheet located in your journal packet.
If this sheet is not completed before you go to launch your rocket, your team will losepoints.

Launch:
1) Fill out as much of the flight day log as possible before launching your rocket.
2) Launch rocket.
3) Finish completing flight day log sheet.
4) Turn in water rocket packets to your teacher.

Materials and Price List

The following is your materials and price list. Your team has a budget of $1,000,000. Use money wiselyand keep accurate records of all expenditures. Make sure your NASA consultant (your teacher) has told youif any items on the list are not available! Once you know the items are I stock, you are ready to start. Ifyou use any items that are not on the list, the NASA consultant must approve the items. (You will not becharged a fee for asking about these items.) The NASA consultant will decide how much to charge for theitem(s). A project delay penalty fee will be

assessed for not working, lacking materials, etc. This penaltyfee could be as high as $300,000. If your money runs out, you will operate in the "red" and this will countagainst your team. Use your time and money wisely, and work together as a team! Good luck!

Supplier	Item	Market Price
Bottle Engine Corporation	large bottle (about 2 L) small bottle (about 20 ounces)	200,000 170,000
Aluminum Cans Ltd.	Can	50,000
International Paper Corporation	Cardboard - large sheet Cardboard - small sheet Poster board - large size Poster board - small size Construction Paper - 1 sheet	25,000 15,000 40,000 25,000 10,000
International Tape and Glue Company	Duct Tape- 12 inches Masking Tape - 12 inches Use of hot glue- per 5 minutes Use of regular glue- per session	60,000 50,000 30,000 40,000
Strings, Inc.	60 cm	10,000
Common Earth Corporation	Modeling Clay/ Sculpting Material	10,000
Color Your World Paints and Markers	Spray paint/ object (ex. 1 fin) Use of Markers- per session	40,000 50,000
Plastic Sheet Goods	1 bag	300
Gas to Go (aqua rocket fuel)	½ bottle	5,000
NASA Launch Port	Launch	100,000
NASA Consultation	Questions	3,000

Budget Projection Sheet

Record below all expenses your company expects to incur in the design, construction, and launch of your rocket.

ITEM	QUANTITY	TOTAL COST

Projected Total Cost $

Once you complete this page, **DO NOT** make any changes to it!

Project X-35 Balance Sheet

Company Name _____

Check No.	Date	To	Amount	Balance
			.	.
			.	.
			.	.
			.	.
			.	.
			.	.
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			.	.
			.	.
			.	.
			.	.
			.	.
			.	.

Company Name: _____ Check No. _____

Date _____ , 19____

Pay to the order of _____ $ [ ]

_____ Dollars _____

For _____ Authorized Signature _____

_____ _____

Company Name: _____ Check No. _____

Date _____ , 19____

Pay to the order of _____ $ [ ]

_____ Dollars _____

For _____ Authorized Signature _____

_____ _____

Company Name: _____ Check No. _____

Date _____ , 19____

Pay to the order of _____ $ [ ]

_____ Dollars _____

For _____ Authorized Signature _____

_____ _____

Company Name: _____ Check No. _____

Date _____ , 19____

Pay to the order of _____ $ [ ]

_____ Dollars _____

For _____ Authorized Signature _____

_____ _____

Rocket Stability Determination

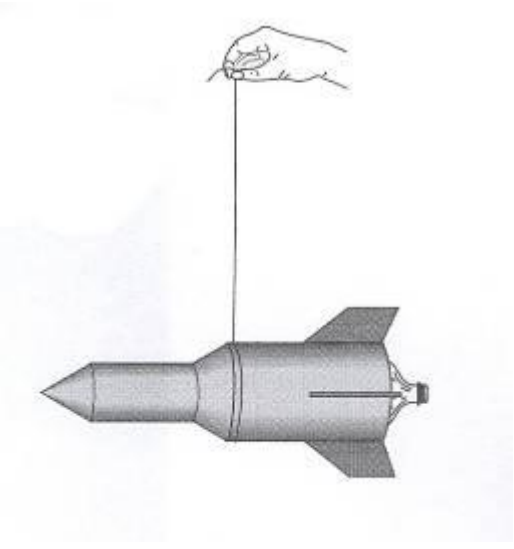
A rocket that flies straight through the air is said to be a stable rocket. A rocket that veers offcourse or tumbles wildly is said to be an unstable rocket. The difference between the flight of astable and unstable rocket depends upon its design. All rockets have two distinct "centers."The first is the center of mass. This is a point about which the rocket balances. If you couldplace a ruler edge under this point, the rocket would balance horizontally like a seesaw. Whatthis means is that half of the mass of the rocket is on one side of the ruler edge and half is onthe other. Center of mass is important to a rocket's design because if a rocket is unstable, therocket will tumble about this center.

The other center in a rocket is the center of pressure. This is a point where half of the surfacearea of a rocket is on one side and half is on the other. The center of pressure differs fromcenter of mass in that its location is not affected by the placement of payloads in the rocket.This is just a point based on the surface of the rocket, not what is inside. During flight, thepressure of air rushing past the rocket will balance half on one side of this point and half on theother. You can determine the center of pressure by cutting out an exact silhouette of therocket from cardboard and balancing it on a ruler edge.

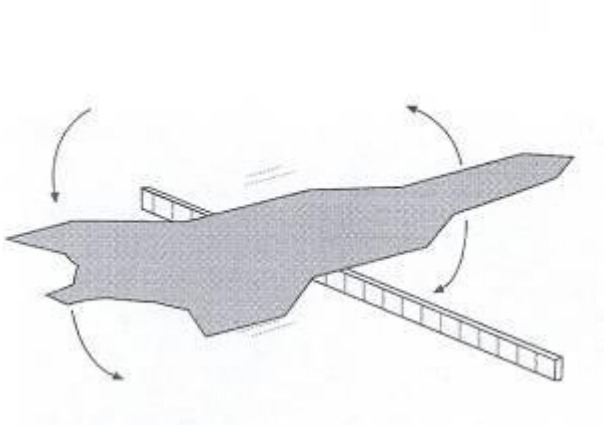
The positioning of the center of mass and the center of pressure on a rocket is critical to itsstability. The center of mass should be towards the rocket's nose and the center of pressureshould be towards the rocket's tail for the rocket to fly straight. That is because the lower endof the rocket (starting with the center of mass and going downward) has more surface areathan the upper end (starting with the center of mass and going upward). When the rocket flies,more air pressure exists on the lower end of the rocket than on the upper end. Air pressurewill keep the lower end down and the upper end up. If the center of mass and the center ofpressure are in the same place, neither end of the rocket will point upward. The rocket will beunstable and tumble.

Stability Determination Instructions

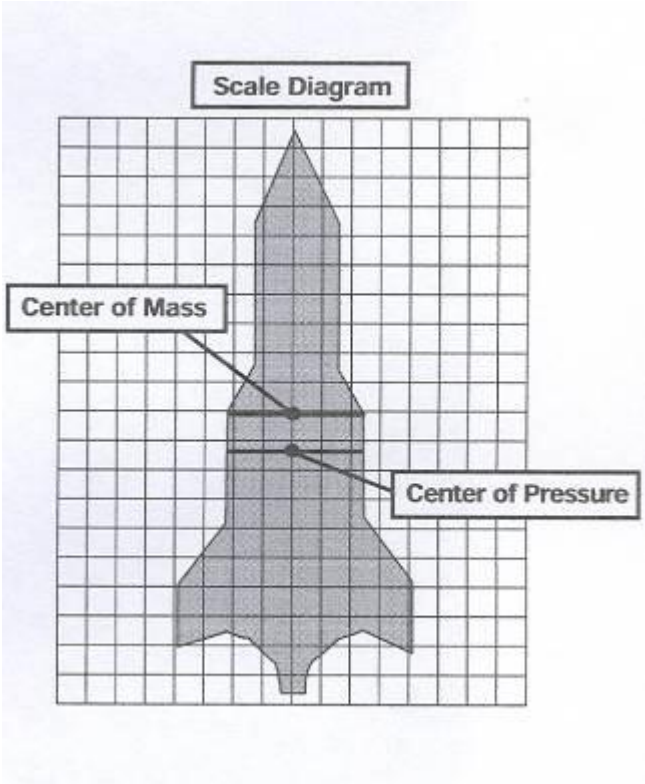
1. Tie a string loop around the middle of yourrocket. Tie a second string to the first sothat you can pick it up. Slide the stringloop to a position where the rocketbalances. You may have to temporarilytape the nose cone in place to keep it fromfalling off.
2. Draw a straight line across the scalediagram of the rocket you made earlier toshow where the ruler's position is. Markthe middle of the line with a dot. This isthe rocket's center of mass.



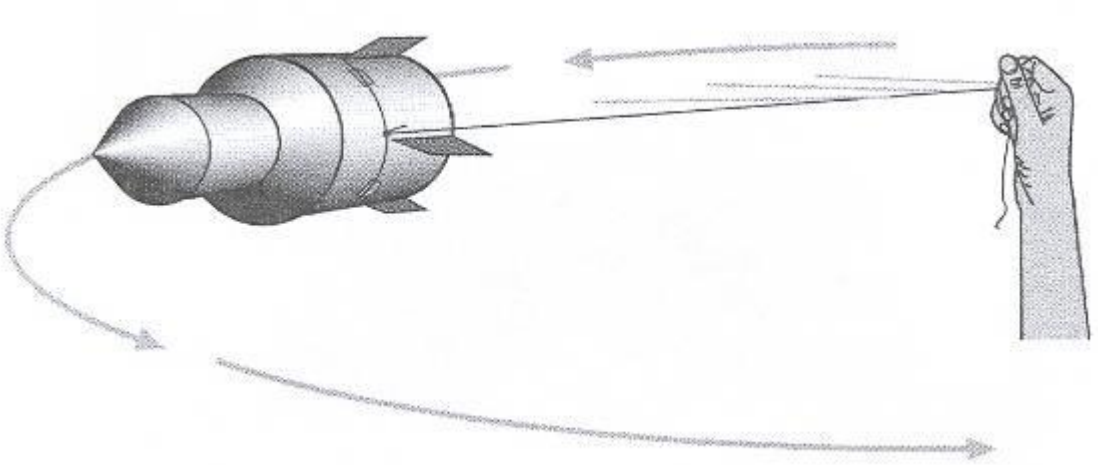
3. Lay your rocket on a piece of cardboard.Carefully trace the rocket on the cardboardand cut it out.
4. Lay the cardboard silhouette you just cutout on the ruler and balance it.
5. Draw a straight lineacross the diagram ofyour rocket where theruler is. Mark themiddle of this line with adot. This is the centerof pressure of therocket.



If your center of mass is in front of the centerof pressure, your rocket should be stable.
Proceed to the swing test. If the two centersare next to or on top of each other, add moreclay to the nosecone of the rocket. This willmove the center of mass forward. Repeatsteps 2 and 3 and then proceed to the swingtest.



Swing Test:
1. Tape the string loop you tied around yourrocket in the previous set of instructions sothat it does not slip.
2. While standing in an open place, slowlybegin swinging your rocket in a circle. Ifthe rocket points in the direction you areswinging it, the rocket is stable. If not, addmore clay to the rocket nose cone orreplace the rocket fins with larger ones.Repeat the stability determinationinstructions and then repeat the swing test.



Rocket MeasurementsFor Scale Drawing

Project No. _____

Date_____

Company

Name_____

___

Use metric measurements to measure and record the data in the blanks below.

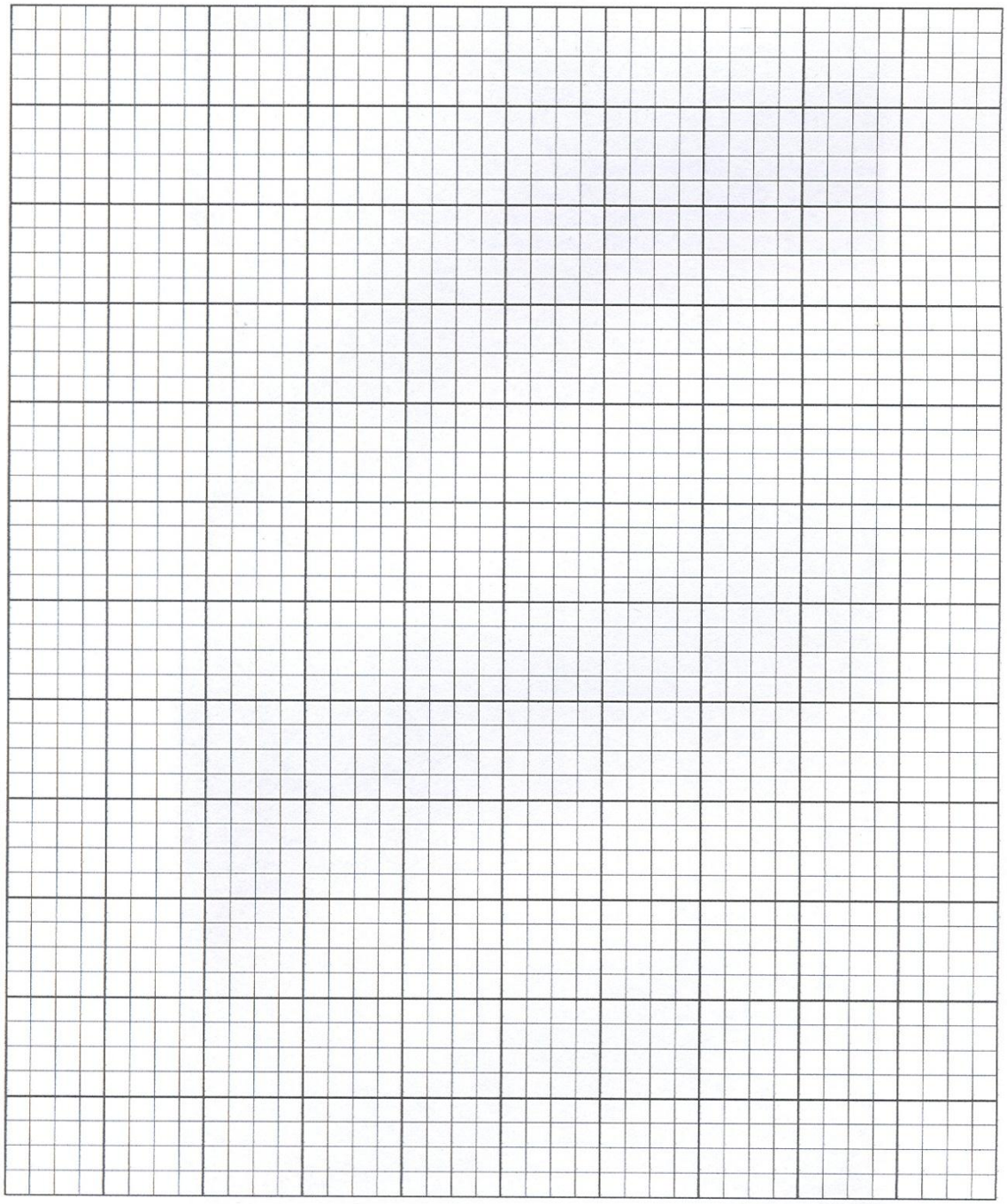
Be sure to accurately measure all objects that are constant (such as the bottles) and thoseyou will control (like the size and design of fins). If additional data lines are needed, use theback of this sheet.

Object	Length	Width	Diameter	Circumference

Using graph paper draw a side, top, and bottom view of your rocket, to scale
(1 square = 2 cm), based on the measurements recorded above. Attach your drawings tothis paper.

Scale Drawing

1 square = 2 cm



Flight Day Log

Date: _____

Time: _____

Project No. [ ]

Company Name: _____

Members: _____

Weather Conditions: _____

_____

Wind Speed: _____ Wind Direction: _____

Air Temperature: _____°C

Launch Location: _____

Launch Angle (degrees): _____ Launch Direction: _____

Fuel (water) volume: _____ mL _____ L

Flight Altitude: _____ M

Evaluate your rocket's performance:

Recommendations for future flights:

Project X-35 Rocket Score Sheet

Team _____ Business Name _____ Score _____

Members' names_____

Journal Cover- neat, creative

0 1 2 3 4 5 6 7 8 9 10

Budget Projection & Balance Sheet- neat, understandable

0 1 2 3 4 5 6 7 8 9 10

Measurement Sheet-neat, understandable, looks accurate, measured in centimeters

0 1 2 3 4 5 6 7 8 9 10

Scale Drawing -includes correct center of mass and pressure

0 1 2 3 4 5 6 7 8 9 10

Flight Day Log Sheet

0 1 2 3 4 5 6 7 8 9 10

Difference between budget projection & final amount on balance sheet

Over $200,000 **1** $100,000-199,999 **2** $50,000-99,999 **4** $10,000-49,999 **6** $5,000-9,999 **8**
$1,000-4,999 **9** Under $1,000 difference **11**

Teamwork -consider any penalties and the way the group worked
-Scored by counselor.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Rocket Appearance –creative, neat, cool
-Scored by support counselor launching rockets.

0 1 2 3 4 5 6 7 8 9 10 11

Rocket Launch Performance
-Scored by support counselor launching rockets.

0 1 2 3 4 5 6 7 8 9 10 11

Educational Robotics

Target groups
Primary school (9 – 11 years old)
Lower secondary school – middle school (11 – 14 years old)

Aims
learning about robotics is important not only for those students who want to become robotics engineers and scientists, but for every student, because it provides a strong method of reasoning and a powerful tool for grappling with the world. The use of educational robotics aims to improve the learning of science and technology, using problem solving methodology. It has proved particularly significant in promoting girls' interest in practical learning of science subjects.

Key competences
- communication in the mother tongue;
- communication in foreign languages;
- mathematical competence and basic competences in science and technology;
- digital competence;
- learning to learn;
- spirit of initiative and entrepreneurship;

Duration
All the year long

Place
Classroom, the web (sharing experiences)

Short description of the activity
First of all an introduction to robotics and roboetics to obtain a brainstorming about the topics and understand the fields in which they are involved. This fact will drive students to understand interdisciplinary links between robotics and all the subjects they study. Second step is to teach methodologies at the basis of educational robotics, the way of building and programming a robot. To obtain these targets they will be driven in several case they will have to resolve. Third step regards the use of language and students are stimulated to tell the procedures they used to

gain results, using open source tools for communication and documentation.

Evaluation
Growing of competences, improved ability of making hypothesis and getting solutions.

Materials / Resources
Kit Lego® WeDo and Kit Lego® Mindstorms, computer, IWB, web-sites, webconferencing, wiki, blogs, videoclips, podcasts, books, IT platforms (network of schools).

School subjects/areas
Interdisciplinarity

Short theoretical background (if applicable)
Introducing educational robotics as an educational tool to teach disciplines means showing a technology that will grow in the future. Conceptualizing, designing, building and programming robots means operating with many concepts in mathematics, physics, computer science, biology, technology, science. Abstract concepts become concrete concepts for students to manage, to tell, to be documented. Educational robotics promotes interest in practical learning of science subjects, using problem solving methodology.Using educational robotics with students make them cooperateone each other. It's important to observe that the concept of error (not verdict, but an incentive to improve) allows teachers identifying more easily different kind of intelligences that are often difficult to identify with traditional curricula.

ACTIVITY 1

DISCOVERING CAUSE - EFFECT RELATIONSHIPS
Discovering sensors

Key competences
communication in the mother tongue, mathematical competence and basic competences in science and technology, learning to learn

School subjects/ areas
interdisciplinar activity: maths, physics, science, motherlanguage, foreign languages

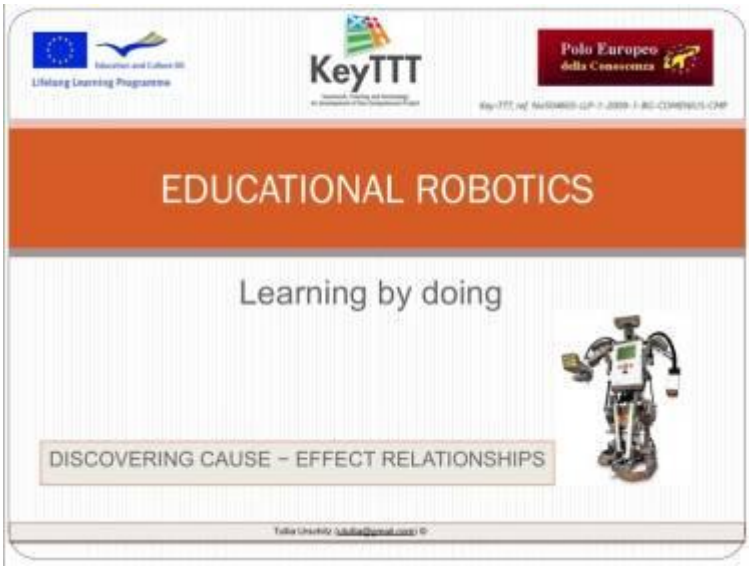
Place
the classroom
Duration

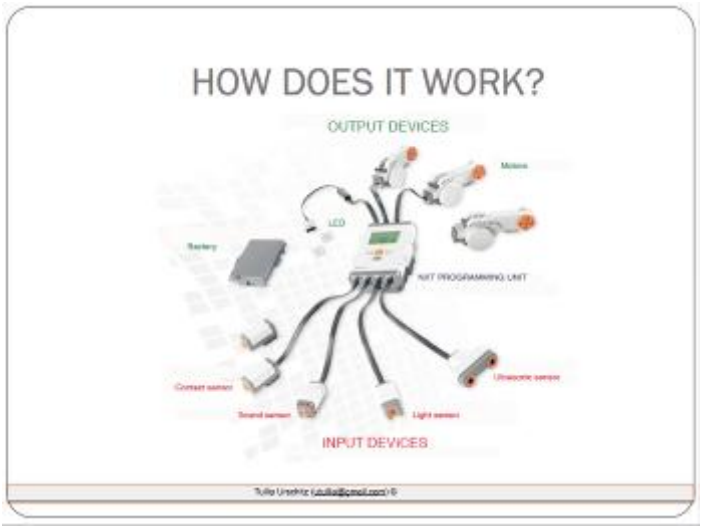
two hours lesson: the first to do the activity, the second for a brainstorming to find out what they learned from the activity.

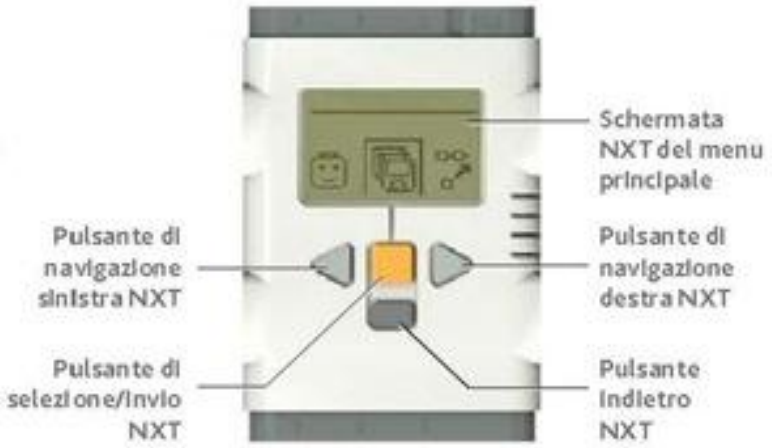
Materials
Lego Mindstorms, IWB, power point to present tasks, students' activity

Activity description
The class is divided into groups of four - five students.
Each group of students has a Lego Mindstorm robot built with different kind of sensors, mounted on it.
Teacher introduces the activities, by showing a presentation (look at the one attached below).
Students analyze their robot, have a brainstorming with their classmates, test each sensor by making the robot running and describe what they observe.
Students, finally, write down their discovers (look at the material prepared to describe activities, attached below) .
To connect this activities with science curriculum teacher introduces human nervous system and sense organs.
Target group
Lower secondary school – middle school (11 – 14 years old)

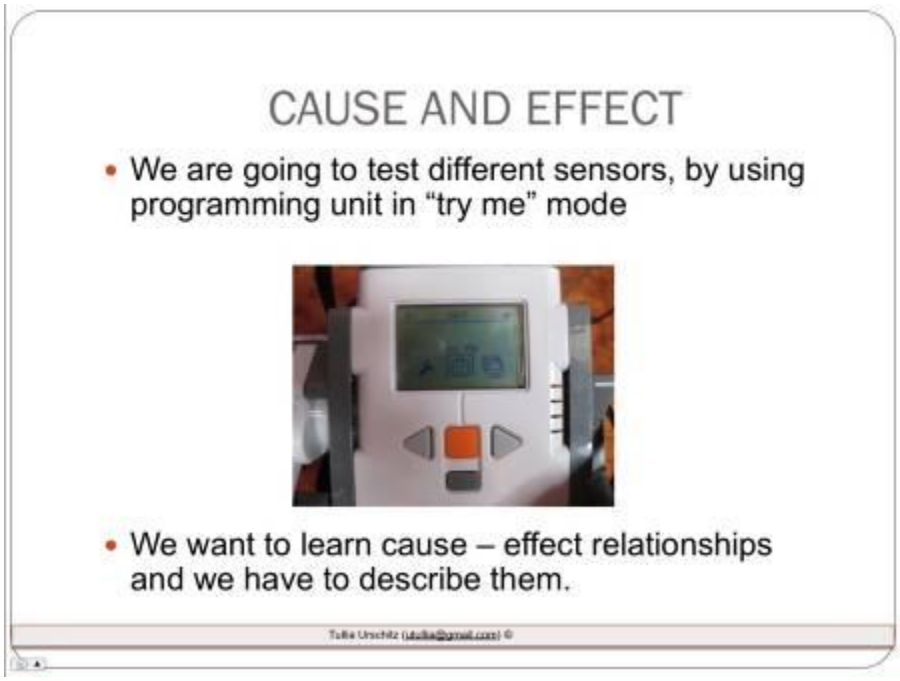
Materials

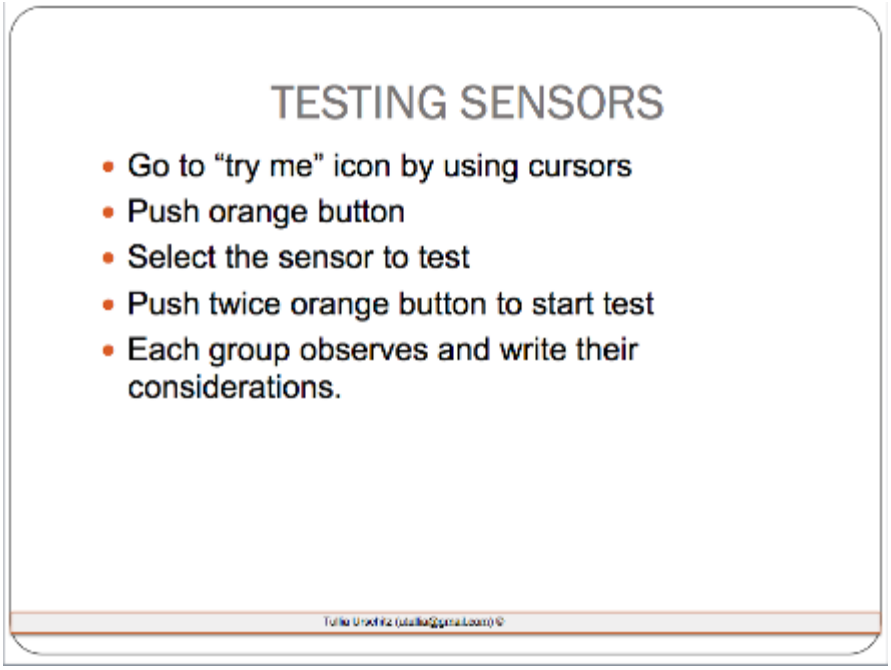


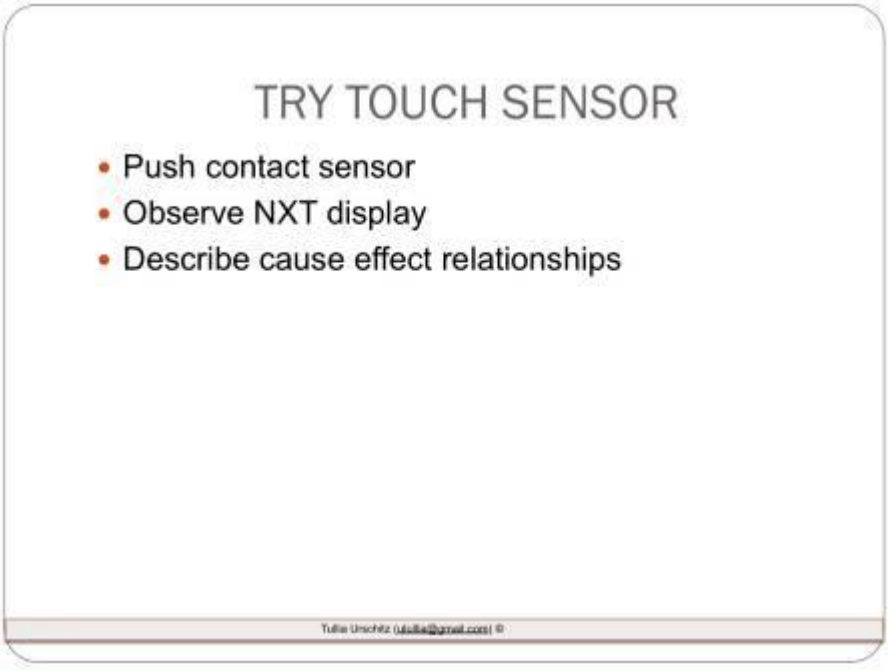

HOW DOES IT WORK?
OUTPUT DEVICES
LED
INPUT DEVICES



Settings (Impostazioni)	**Try Me** (Provami)	My files (I miei file)	**NXT programm** (Programma NXT)	View (Visualizza)	Bluetooth




TESTING SENSORS
Go to “try me” icon by using cursors
Push orange button
Select the sensor to test
Push twice orange button to start test
Each group observes and write their considerations.

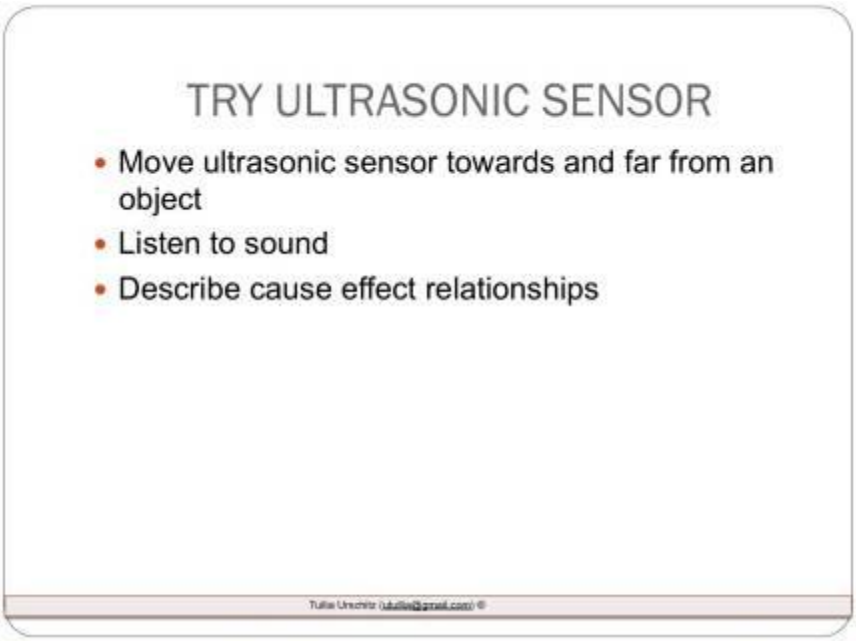

TRY TOUCH SENSOR
Push contact sensor
Observe NXT display
Describe cause effect relationships

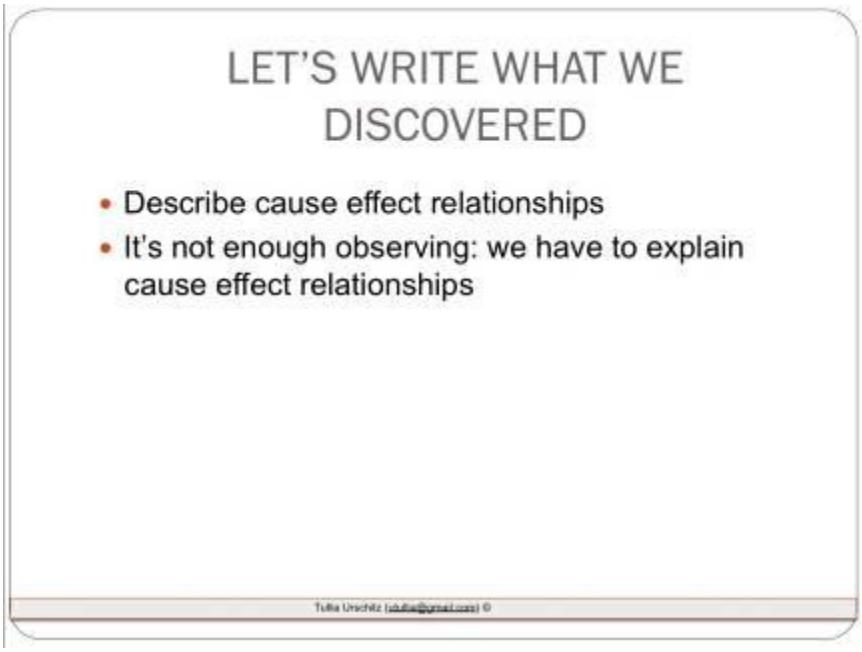
TRY SOUND SENSOR

- Keep silence, then make different rumors
- Listen to sound
- Describe cause effect relationships

TRY LIGHT SENSOR

- Move light sensor towards light and dark objects
- Listen to sound
- Describe cause effect relationships





STUDENTS' ACTIVITY

DESCRIPTION OF CAUSE-EFFECT RELATIONSHIPS

Each group will test sensors mounted on the robot, working on NXT programming unit, in "try me" mode.
We will research cause – effect relationships for each sensor.
Each group will observe and write his considerations.

To enter "try me" mode:

- Switch on NXT
- Select "try me" icon by pushing cursors
- Push orange button
- Select the desired sensor by pushing cursors
- Start the program by switching the orange button twice

TRY TOUCH SENSOR
Observe and describe :
……
……
……
……

TRY SOUND SENSOR
Observe and describe :
……
……
……
……

TRY LIGHT SENSOR
Observe and describe :
……
……
……
……

TRY ULTRASONIC SENSOR
Observe and describe :
……
……
……
……

ACTIVITY 2

USE OF THE LANGUAGE
Describe building procedure

Target group
Lower secondary school – middle school (11 – 14 years old)

Key competences
communication in the mother toungue, communication in foreign languages, mathematical competences, learning to learn

School subjects/ areas
interdisciplinar activity: maths, science, motherlanguage, foreign languages
Place
the classroom

Duration
two lessons: the first to do the activity, the second for a brainstorming to find out what they learned from the activity.

Materials
Lego Mindstorms (or other bricks), IWB

Activity description
The class is divided into groups of two students.
Each couple of students receives an object composed of a few pieces of Lego Mindstorms, assembled as shown (or in other ways, but make sure to take a picture of the starting materials).
Students analyze the object received, dismantled in order to understand the assembly instructions and write down instructions for its replacement.
Students, finally, will give both instructions and disassembled Lego pieces to the countiguous couple of students.
The contiguous couple of students should be able, with the instructions and disassembled Lego pieces, to assemble again the object as it was originally.

(an example for the brainstorming)

Difficulties encountered
Someone did not read well the delivery and removed pieces before writing the procedure for reassembly.
It is difficult to write clear instructions if the pieces don't have a name that makes it easy identifing them.
It is difficult to reassembly the object assigned if the instructions are not clear and detailed.

What did we learn?
It is important to use a clear and proper language.
It is necessary to give a name to pieces, so everyone can identify objects, without making any mistake.
It is important to observe carefully.
It is essential to read deliveries carefully, to be able to perform with precision the task assigned.

STUDENTS' ACTIVITY

DESCRIPTION OF CAUSE-EFFECT RELATIONSHIPS

Each group will test sensors mounted on the robot, working on NXT programmino unit, in "try me" mode.
We will research cause – effect relationships for each sensor.
Each group will observe and write his considerations.
To enter "try me" mode:

- Switch on NXT
- Select "try me" icon by pushing cursors
- Push orange button
- Select the desired sensor by pushing cursors
- Start the program by switching the orange button twice

TRY TOUCH SENSOR
Observe and describe:
……
……
……
……

TRY SOUND SENSOR
Observe and describe:
……
……
……
……

TRY LIGHT SENSOR
Observe and describe:
……
……
……
……

TRY ULTRASONIC SENSOR
Observe and describe:
……
……
……
……

Multimedial math and science

Target groups
Primary school (9 – 11 years old)
Lower secondary school – middle school (11 – 14 years old)

Aims
Keeping students' attention, working with collaborative approaches, explaining difficult concepts by using multimedia support, stimulating cooperative learning.

Key competences
communication in the mother tongue;
communication in foreign languages;
mathematical competence and basic competences in science and technology;
digital competences;
learning to learn;
spirit of initiative and entrepreneurship;

Duration
All the year long

Place
Classroom, computer lab, home

Short description of the activity
Teacher present some topics to students, without using a frontal lesson, but as a new problematic situation. A first brainstorming is useful to understand what are things known and to make questions and dubts emerging. IWB is an useful instrument to get the attention of the whole class on the topic. Basing on questions and on students prerequisites, teacher explains lesson or investigation aims, introduces requirements, defines processing method and roles distribution.
The target will get by cooperating, finding informations and chosing instruments, discussing with classmates, elaborating ipothesys and, finally, writing and sharing with others.

Evaluation
Growing of competences, improved ability of cooperative working.

Materials / Resources
Computer, projector, IWB, use of softwares like OpenOffice, Gimp, GeoGebra, Scratch, Cmap, web pages on a wiki or on a blog

School subjects/areas
All subjects: expecially maths, ICT, sciences, and also interdisciplinarity

Short theoretical background (if applicable)
IWB and the availability of computers in classrooms, as well as the regular use of computer lab, let students learn through researching / discovering / processing (through problem solving), done by workingin a group (cooperative learning) and, for older students from home, through research / discovery / sharing materials in the wiki or blog (net-learning). The teacher's role is to guide students to use documents to build, discover and think up to concepts, ideas, theories.
By using a wiki or a blog students learn how to write and publish on the web. They also learn about Creative Commons Licence and the intellectual property of materials on the web. Each student can cooperate to the final product, by adding materials, sharing point of view, reading what other editors on the wiki/blog do.
By working with projects that use multimedia, students learn to select, to create and to manage many kinds of media, including text, images, animation. As students gain experience working with media, they become more perceptive and critical in analyzing the media they see in the world around them.

ACTIVITY

MULTIMEDIAL MATHS
Working with geometry

Target group
Lower secondary school – middle school (11 – 14 years old)

Key competences
communication in the mother toungue, mathematical competences and technology, digital competences, learning to learn, sense of initiative and entrepreneurship

School subjects/ areas
interdisciplinar activity: maths, science, technology, motherlanguage.

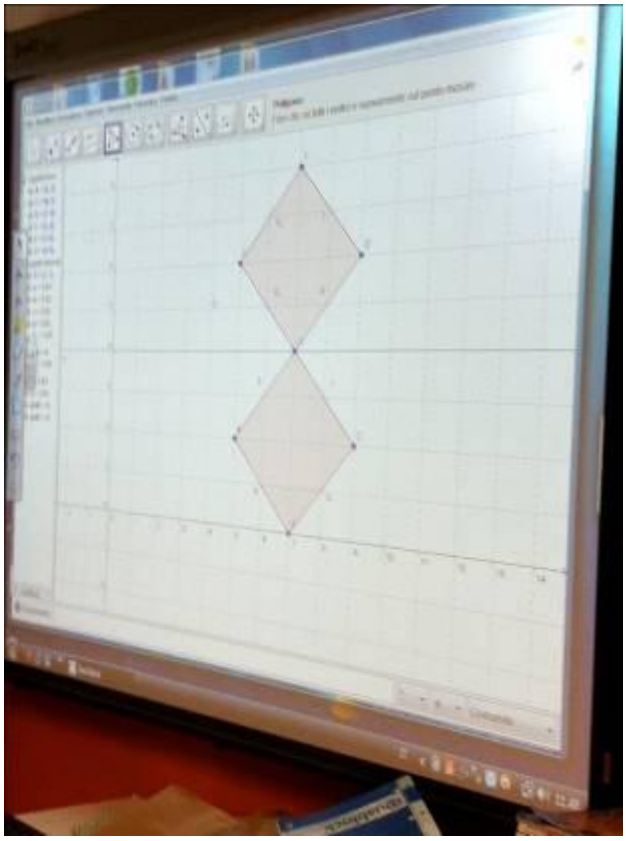
Place

the classroom

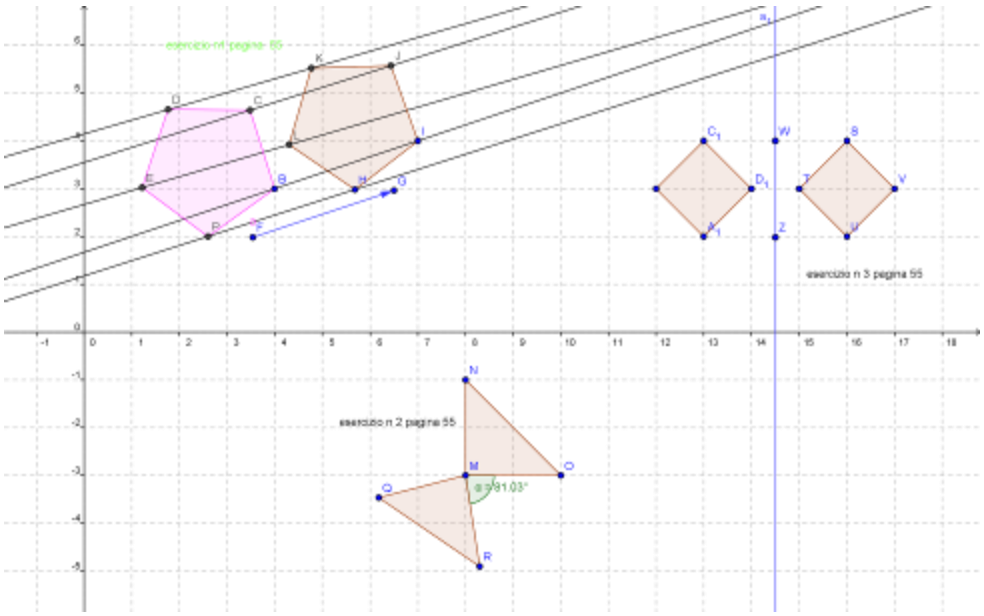
Duration
2 hours lesson: the first is a cooperative working in the class, the second, in the computerlab, requires the individual use of the computer.

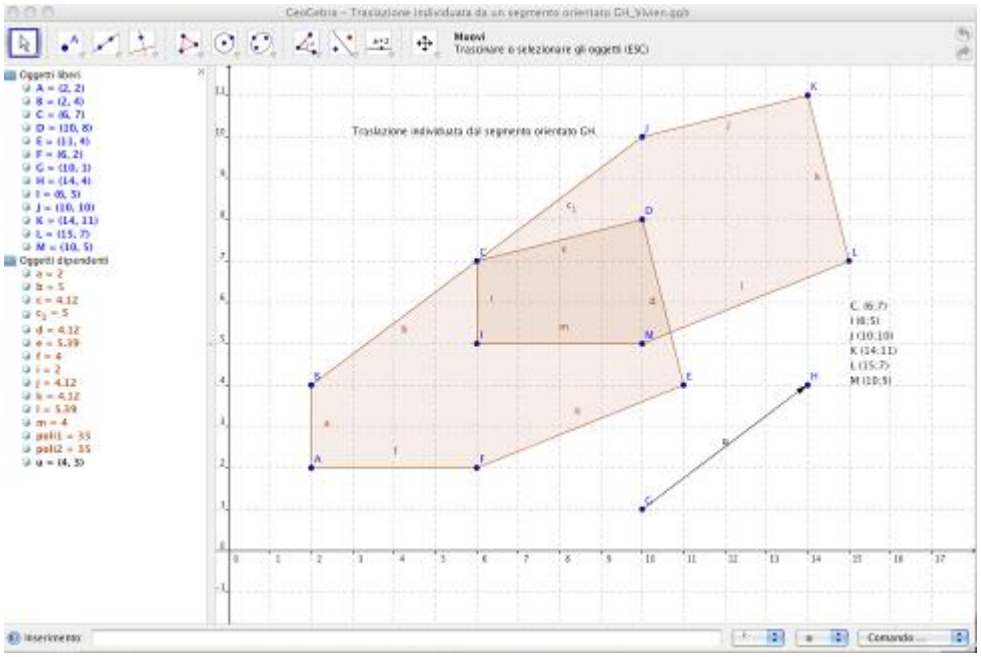
Materials
IWB, computer, GeoGebra software

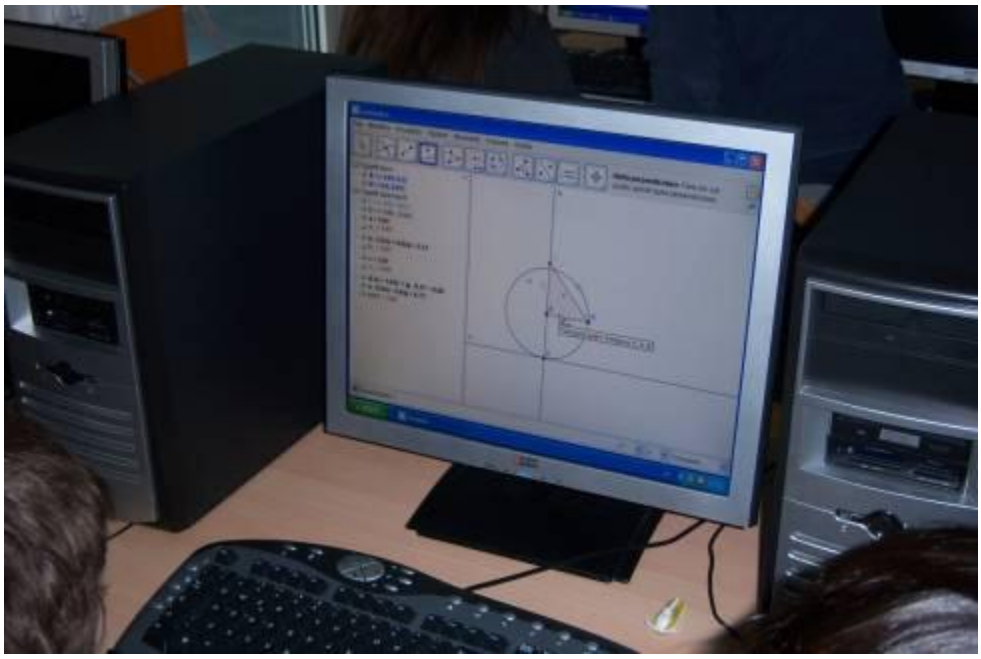
Activity description
1 lesson:
The teacher introduces concepts of segments and angles showing using IWB.
Some students are invited to draw on the IWB, by using GeoGebra software, what they have understand on these topics.
All students in the class give their suggestions.

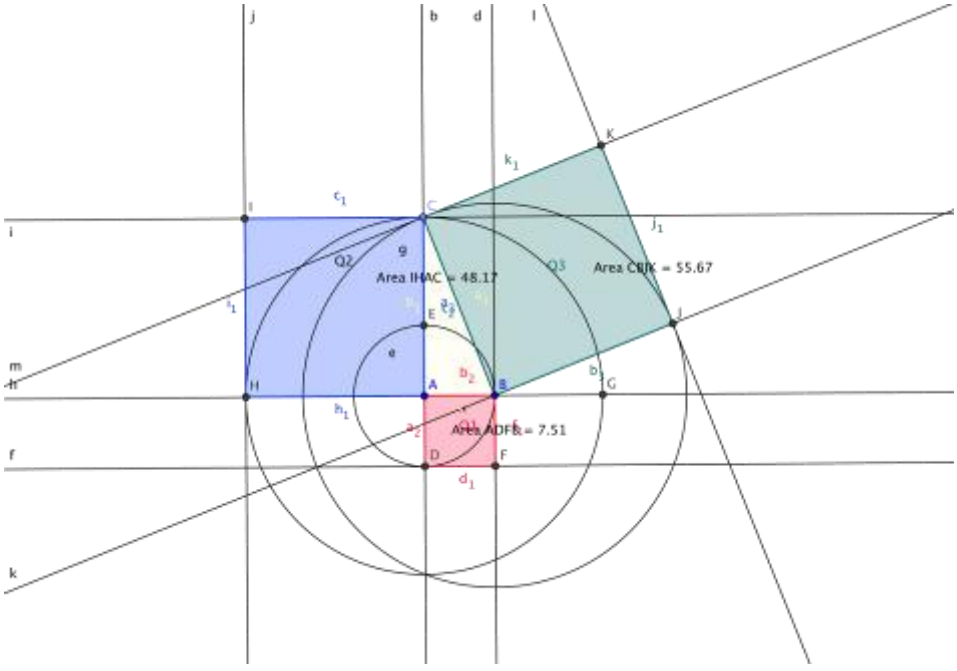


2 lesson:
Each student is invited to draw on a computer what he learned on the topic and to describe it, by writing the procedure he used.

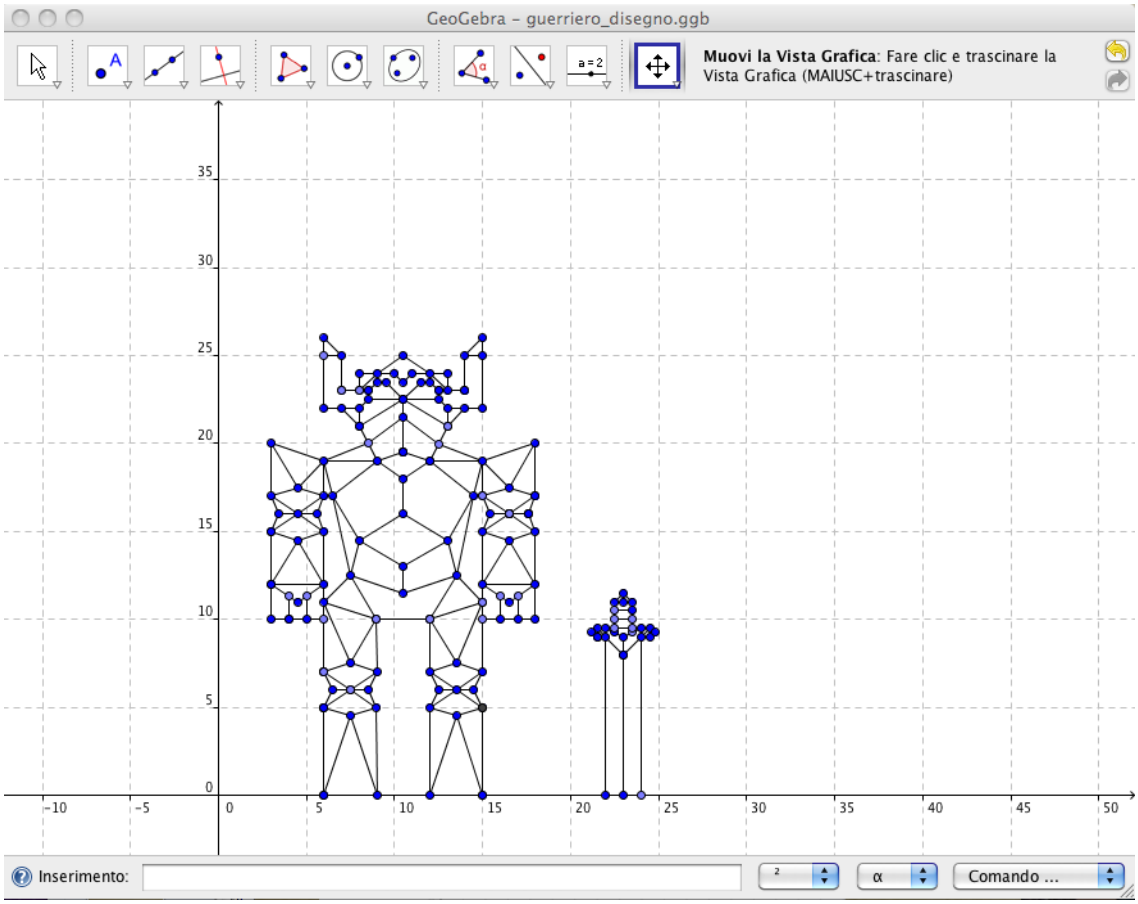

esercizio n 3 pagina 55
esercizio n 2 pagina 55


Nuovi
Trascinare o selezionare gli oggetti (ESC)
Traslazione individuata dal segmento orientato GH




Area IHAC = 48.17
Area CBJK = 55.67
Area ADFE = 7.51

Sometimes students discover that they can use what they learned also to play with fantasy... and it is possible to enjoy themselves with GeoGebra. This is enterpreneurship!



Experimentarium

Target groups
Primary school (9 – 11 years old)
Lower secondary school – middle school (11 – 14 years old)

Aims
The use of laboratory (experimentarium) aims to improve the learning of maths, science and technology, by using problem solving and action learning methodology. By the word ”laboratory“ we mean any intentional activity aimed to achieving a defined and concrete outcome, through a series of procedures and specific activities controlled by students and meaningful for them (learning by doing).

Key competences
communication in the mother tongue;
communication in foreign languages;
mathematical competence and basic competences in science and technology;
learning to learn;
spirit of initiative and entrepreneurship;

Duration
1 – 2 hours

Place
Classroom, outdoors

Short description of the activity
Problematic situation arise from dynamic processes and constructions in which students are stimulated by the teacher that lead them into a cooperative manner to the discovery of possible routes.

Evaluation
Growing of competences, improved ability of cooperative working.

Materials / Resources
Computer, projector, IWB, real objects, part of animals, plants, rocks….

School subjects/areas
All subjects: expecially maths, sciences and technology

Short theoretical background (if applicable)
Learning by doing can transform actions in knowledge, knowledge into competences, competence into skills. This methodology helpsstudents to reflect on the way they use to achieve objectives, so they realize their active way of learning; it stimulates communication and sharing of ideas, although considered wrong, because the comparison created new paths and new solutions. The teacher helps student to reflect on possible errors, in order to initiate a first experience of self-correction and self-evaluation, comparison of routes and ways to stimulate new ideas and new goals.
Working on real situations, to solve problematic situations, means operating with many concepts of mathematics, physics, computer science, biology, technology, science. Abstract concepts become concrete concepts for students to manage, to tell, to be documented. Learning by doing promotes interest in practical learning of science subjects, using problem solving methodology.

ACTIVITY 1

GROSS WEIGHT, NET WEIGHT & TARA
Experimentarium

Target group
Primary School (9 – 10 years old)

Key competences
communication in the mother toungue, mathematical competence learning to learn.

School subjects/ areas
interdisciplinar activity: maths, science, motherlanguage.

Place
the classroom

Duration
1 hour lesson

Materials
exercise book, text book, balance, weights, different kind of objects

Activity description
The activity starts with a brainstorming, to understand what students know on the topic.
Put on the balance a box of crayons and weigh it.
Put on the balance crayons, alone.
Write on the blackboard weights and ask pupils to discover the weight of the box (tara).

Encourage students discovering the rule.
Find other objects to make students reinforcing the knowledge.

Teacher suggestions

Questions are the starting point, to:
- motivate and interest the students;
- make the students reflect and observe;
- raise hypotheses and links.

Ask students to reflect on the meaning of the words "gross weight", "net weight" and "tare weight" to see if someone could explain them.
Go to the operative phase, in which is necessary to show what "gross weight", "net weight" and "tare weight" are and which are their relationship.
Bring a weight scale and weight first a tin of felt-tip pens – (f.i.260 grammes) –, then only felt-tip pens – (f.i.230 grammes) – and finally the empty tin – (f.i.30 grammes) –. Write the gathered data on the blackboard (using the same unit of measure, to simplify the observations) and ask students for their observations.
Write the formula: TARE WEIGHT = GROSS WEIGHT – NET WEIGHT.
Ask pupils to represent with a diagram what they can observe.
In order to reinforce and simplify the other two formulas referring to the same topic, I propose other practical situations f.i. one with a box of apples, the other one with a box of chocolates.
Give tables to complete and simple problems to solve, where gross weight, net weight and tare weight have to be found.
In a second moment, give them more difficult problems, giving the weight data in two different units of measure, to stimulate students to use equivalences before doing operations.

ACTIVITY 2

EXPERIMENTS ABOUT THE AIR

Target group
Primary School (9 – 10 years old)

Key competences
communication in the mother toungue, mathematical competence learning to learn.

School subjects/ areas
interdisciplinar activity: maths, science, motherlanguage.

Place
the classroom

Duration
1 hour lesson

Materials
exercise book, a trasparent basin, a quite large container made of glass, a candle, matches, water coloured with mint syrop

Activity description
The activity starts with a brainstorming, to understand what students know on the topic.
Double aim:
to make the students aware that air is in every space we think to be empty;
to make evidence that almost the fifth part of air consisted of oxygen.
Fix the candle in the middle of a plate with some drops of melted wax and cover it with a jar of glass.
See what happens and ask pupils for explaining what they observed.
Ask pupils to make some hypotesis on what would happen if there is some water on the plate.

Light the candle, fix it on the plate, pour some coloured water (use mint syrop) and cover it with a jar of glass.
See what happens and ask pupils for explaining what they observed.

Teacher suggestions

Before performing the experiments, ask students to give their hypotheses about what is necessary to make the candle burning.
Drive them to discover that the fire needs air to keep on burning.

EXPERIMENT N.1:
Fix a candle in the middle of a plate helping yourself with some drops of melted wax and then cover the candle with a jar of glass. Observe while the candle burned out.
Ask pupils to represent on their exercise books what theyobserved, following the steps of the scientific method: observation – hypothesis – verification - conclusion.

Later, to emphasize in a practical manner that 21% of air is oxygen (that means 1/5), repeat the same experiment, setting the candle on a plate containing a little quantity of water.

EXPERIMENT n.2:
Light the candle and fix it in the middle of the plate. Put in the plate some water with mint syrup, to make the liquid visible. Cover the candle with the jar of glass and, let students observe that, as soon as the candle burned out, the water rised up the jar, filling almost 1/5 of the space. Drive students to understand that the candle needs oxygen to burn, and this is the reason why, when the oxygen under the jar finish, it lets a depression that is compensated by sucking the water in the plate.

N.B.: it would be good to explain students that the explanation about water rising up 20% of the jar is not just referable to the fact that oxygen consumes. Infact the oxygen does not disappear from the jar, but combines and transforms in carbon dioxide (CO_2)...

Cartography

Target groups
Primary school (8 – 9 years old)

Aims
Providing students with methodological skills for researching, studying documents and sharing products on the web. Learning how to assess process variables.
Make students being able to use IT platforms and softwares for word processing, presentations and data processing (spreadsheets).

Key competences
communication in the mother tongue;
mathematical competence and basic competences in science and technology;
learning to learn;
spirit of initiative and entrepreneurship;

Duration
2 months

Place
Classroom, outdoors, computerlab

Short description of the activity
Problematic situation arise from dynamic processes and constructions in which students are stimulated by the teacher that lead them into a cooperative manner to the discovery of possible routes.

Evaluation
Growing of competences, improved ability of cooperative working.

Materials / Resources
Computer, projector, IWB, Rulers, squares, metric cord, topographic maps, maps, books, Google Maps

School subjects/areas
Maths, geography, mother language, art and image, technology

Short theoretical background (if applicable)
Learning by doing provide students of competences for the life. Problem solving and collaborative work let students being involved in all phases of the learning process. From the children' s real life (home – school, school

trips) to the experimentation of instruments for measuring and transferring real spaces on paper
Starting from the children's real life, from the observation of reality and its images, pupils can experience the realization of maps, as preliminary activity for the length measures.

ACTIVITY 1

WORKSHOP OF CARTOGRAPHY
From NEVERLAND...

Teacher suggestions
On a map of an area, to make the pupils locate the points of reference of the city: bridges, stretts, particular buildings, gardens, churches ... To explain the importance of the cardinal points, which are the UNIVERSAL POINTS OF REFERENCE, their position on the map of their country of origin and on the planisphere.
Make the pupils experiment the research of the position of the cardinal points, facing the north, than the south, after the west and finally the east (a test or some written exercises may be proposed).
Make the pupils represent their classroom on their copybook, marking the cardinal points, after having helped the children locate them.
Make the pupils reflect on the necessity that the representation has smaller objects seen from above.
Ask the children the meaning of REDUCTION ON SCALE, gathering their answers (on a poster) and then make the pupils see through examples and exercises the transformation resulting from the application of some reductions on scale (1:2 – 1:3 …).
Make observe the presence of the index of reduction on scale on the maps used for marking the ways of the school trips.
Present various kinds of maps: maps, topographic maps, geographic maps and think about their differences.
Give a geographic map and make locate some places using the cardinal points as reference (ex. To locate the cities in the north of...) THIS ACTIVITY MAY BE USED AS TEST
Give the students a map with some symbols of buildings or parks of the territory and ask them to complete some sentences inserting the cardinal points (ex. The stationery is … of the bookshop).
Make the pupils draw a map which represents the island of the beginning, asking them to use the leanrt symbols, the reduction on scale and the position relating the cardinal points.

Get the pupils curious through the drawing of a map of a inexistent island (a sort of treasure map).

Make the pupils describe orally the way they get from home to school, represent it on their exercise book and write it using specific geographic words.
Make the pupils reflect on some points everyone knows, which may be defined POINTS OF REFERENCE. Pupils may look for them on the maps so that every pupil may individuate his position.
Every school trip may be introduced by the presentation of the city map, so that the pupils may draw the way they will get, marking in different colours the starting point, the streets and the arrival point.
On a map of an area, to make the pupils locate the points of reference of the city: bridges, streets, particular buildings, gardens, churches ... to explain the importance of the cardinal points, which are the UNIVERSAL POINTS OF REFERENCE, the position of their country of origin on the map and on the planisphere.
Make the pupils experiment the research of the position of the cardinal points, facing the north, than the south, after the west and finally the east (a test or some written exercises may be proposed).
Make the pupils represent their classroom on their copybook, marking the cardinal points, after having helped the children locate them.
Make the pupils reflect on the necessity that the representation has smaller objects seen from above.
Ask the children the meaning of REDUCTION ON SCALE, gathering their answers (on a poster) and then make the pupils see through examples and exercises the transformation resulting from the application of some reductions on scale (1:2 – 1:3 …).
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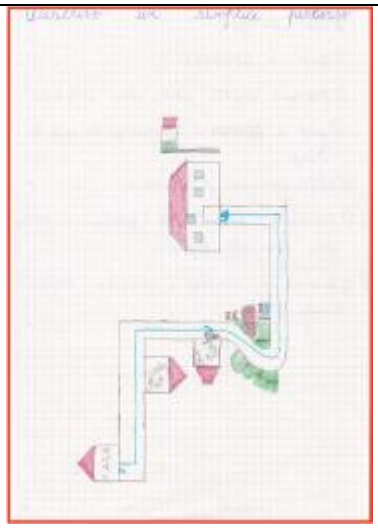
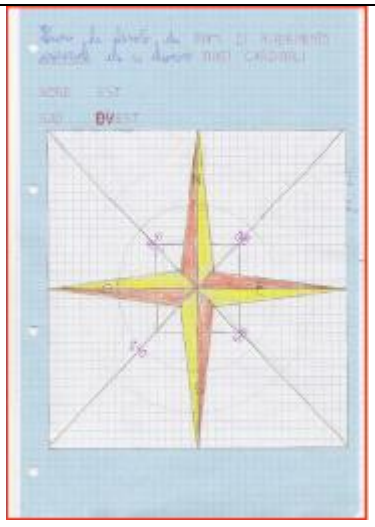
Make the pupils draw a map which represents the island of the beginning, asking them to use the leanrt symbols, the reduction on scale and the position relating the cardinal points
Observe and describe a real island…


Dall'isola
che
non c'è...
ALICE!






SRI LANKA

Working on a network

Target groups
Lower secondary school – middle school (11 – 14 years old)

Aims
Providing students with methodological skills for researching, studying documents and sharing products on the web. Learning how to assess process variables.
Make students being able to use IT platforms and softwares for word processing, presentations and data processing (spreadsheets).

Key competences
communication in the mother tongue;
communication in foreign languages;
mathematical competence and basic competences in science and technology;
digital competences;
learning to learn;
spirit of initiative and entrepreneurship;

Duration
4 months

Place
Classroom, computer lab, home

Short description of the activity
A network of schools focuses on a common survey (alimentation, f.e.). Students study documents they are given (like webquests), have a brainstorming, create a questionnaire, spread it, collect results and elaborate data. The final product could be a presentation and analysis of results. Several schools work together, from the north to the south of Italy, using a IT platform to share materials and results.

Evaluation
Documents analysis, creation of questionnaires, data processing, publication of survey results.

Materials / Resources
Spreadsheets, word processor, presentation tools, IT platform, wiki

School subjects/areas
Maths, statistics, informatics, science and interdisciplinary for surveying focus

Short theoretical background (if applicable)
Learning by doing provide students of competences for the life. Problem solving and collaborative work let students being involved in all phases of the learning process.
Teachers become coaches and cooperative learning is the way to get final results.

ACTIVITY

COLLABORATIVE STATISTICS
Working on a network

Target group
Lower secondary school – middle school (11 – 14 years old)

Key competences
communication in the mother toungue, mathematical competences and technology, digital competences, learning to learn, sense of initiative and entrepreneurship

School subjects/ areas
interdisciplinar activity: maths, science, technology, motherlanguage.

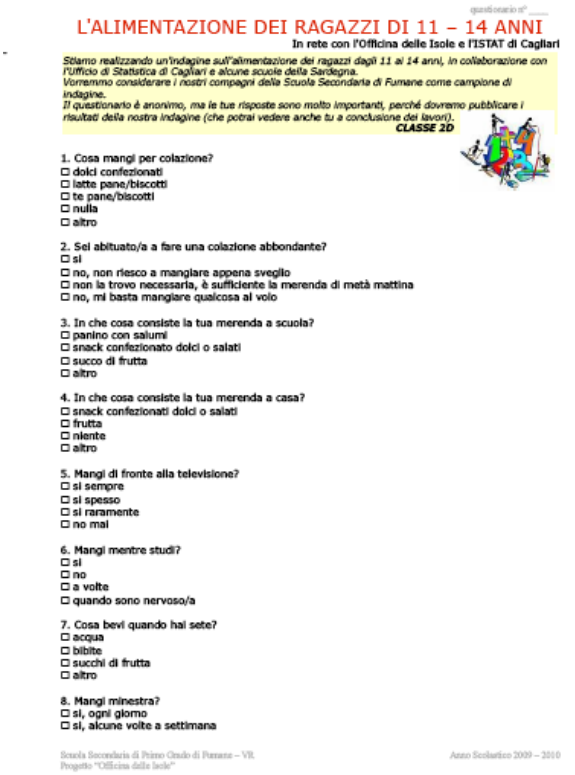
Place
the classroom, the computerlab, the web

Duration
8 lessons: the first to have a brainstorming, the second for learn how to share materials on the network, two lessons to build a common questionnaire, the fifth to spread it, the sixt to elaborate it, the seventh to publish results, the last one to have a final brainstorming on the thinghs learned.

Materials
computer, IWB, network platform (Dokeos), wiki

Activity description
The activity is done in a virtual network of many schools (we used "Dokeos platform" and "PbWorks" to share materials from schools).
The purpose is to give the opportunity to students participating of learning statistics by sharing and comparing experiences in the dialog with peers.
During curricular lessons students learn about statistics fondaments.

Lesson 1: brainstorming activity to define the foundations of the survey (population sample, survey object).
Lesson 2: how to use a web platform and a wiki
Lesson 3: build the questionnaire. Students chose questions to put into the questionnaire and write down on a word file the document. Then share it on the platform and compare other questionnaire from students of other schools.
Lesson 4: build a common questionnaire
Lesson 5: distribute to all students of their school
Lesson 6: elaborate data on a excel spreedsheet
Lesson 7: publish results on the web
Lesson 8: final brainstorming



questionario n° _____

L'ALIMENTAZIONE DEI RAGAZZI DI 11 – 14 ANNI

In rete con l'Officina delle Isole e l'ISTAT di Cagliari

Stiamo realizzando un'indagine sull'alimentazione dei ragazzi dagli 11 ai 14 anni, in collaborazione con l'Ufficio di Statistica di Cagliari e alcune scuole della Sardegna.
Vorremmo considerare i nostri compagni della Scuola Secondaria di Fumane come campione di indagine.
Il questionario è anonimo, ma le tue risposte sono molto importanti, perché dovremo pubblicare i risultati della nostra indagine (che potrai vedere anche tu a conclusione dei lavori).

CLASSE 2D

1. Cosa mangi per colazione?
☐ dolci confezionati
☐ latte pane/biscotti
☐ te pane/biscotti
☐ nulla
☐ altro

2. Sei abituato/a a fare una colazione abbondante?
☐ sì
☐ no, non riesco a mangiare appena sveglio
☐ non la trovo necessaria, è sufficiente la merenda di metà mattina
☐ no, mi basta mangiare qualcosa al volo

3. In che cosa consiste la tua merenda a scuola?
☐ panino con salumi
☐ snack confezionato dolci o salati
☐ succo di frutta
☐ altro

4. In che cosa consiste la tua merenda a casa?
☐ snack confezionati dolci o salati
☐ frutta
☐ niente
☐ altro

5. Mangi di fronte alla televisione?
☐ sì sempre
☐ sì spesso
☐ sì raramente
☐ no mai

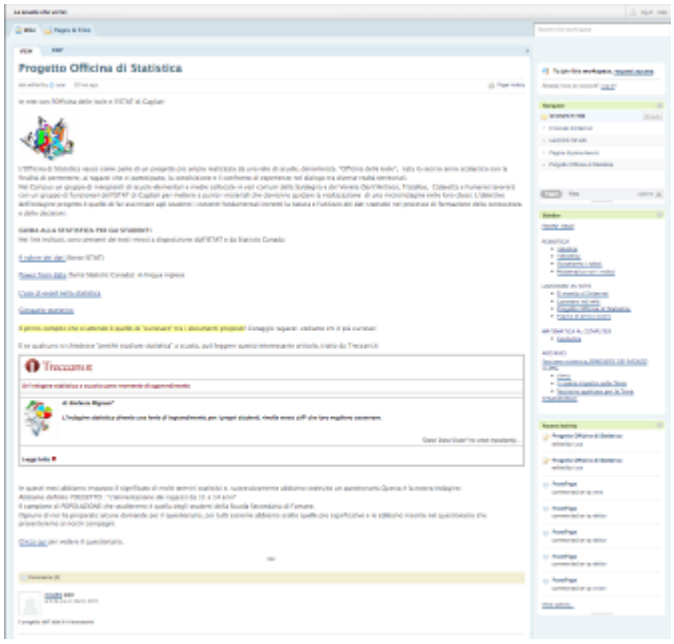
6. Mangi mentre studi?
☐ sì
☐ no
☐ a volte
☐ quando sono nervoso/a

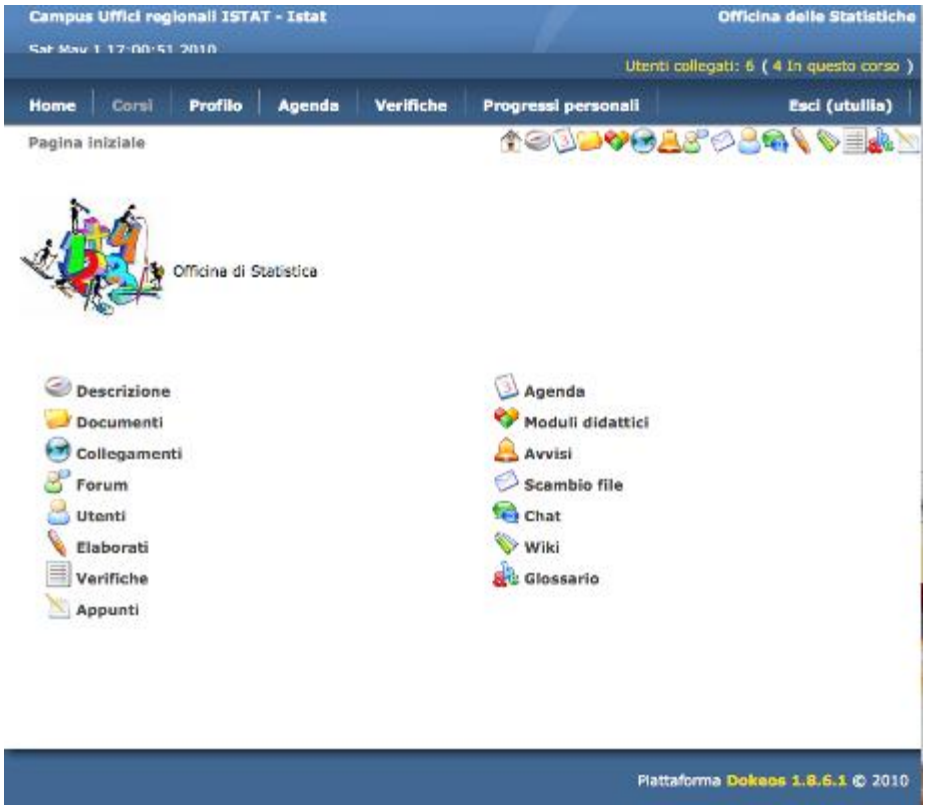
7. Cosa bevi quando hai sete?
☐ acqua
☐ bibite
☐ succhi di frutta
☐ altro

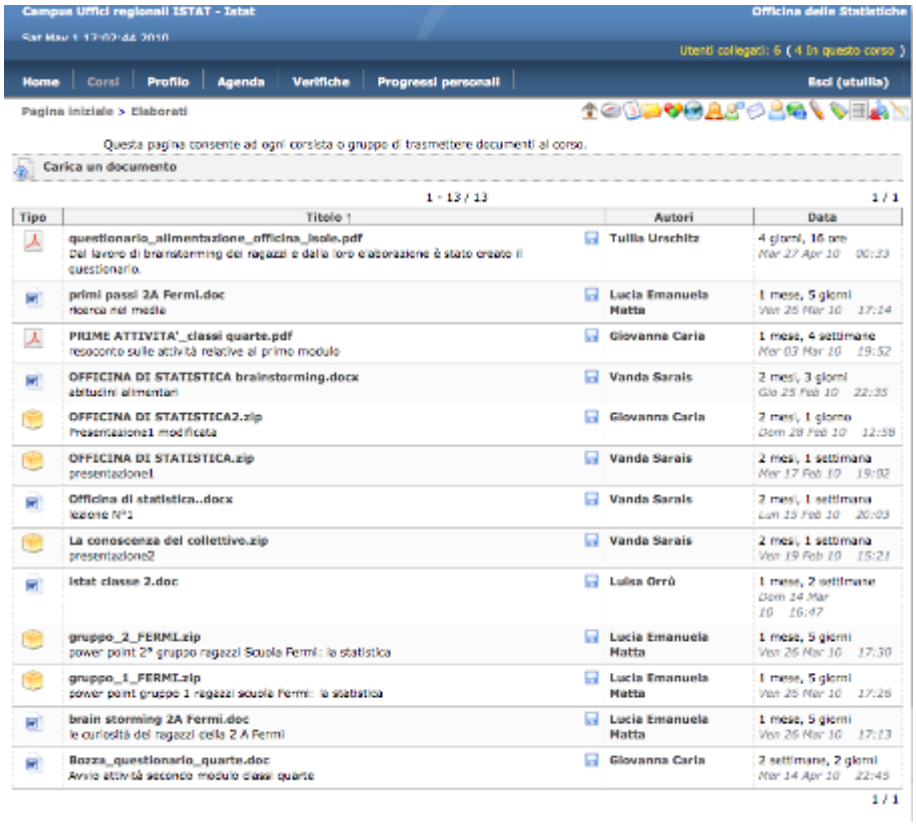
8. Mangi minestra?
☐ sì, ogni giorno
☐ sì, alcune volte a settimana

Scuola Secondaria di Primo Grado di Fumane – VR
Progetto "Officina delle Isole"

Anno Scolastico 2009 – 2010


Progetto Officina di Statistica


Campus Uffici regionali ISTAT - Istat
Officina delle Statistiche
Utenti collegati: 6 (4 in questo corso)
Home
Corsi
Profilo
Agenda
Verifiche
Progressi personali
Esci (utullia)
Pagina iniziale
Officina di Statistica
Descrizione
Documenti
Collegamenti
Forum
Utenti
Elaborati
Verifiche
Appunti
Agenda
Moduli didattici
Avvisi
Scambio file
Chat
Wiki
Glossario
Piattaforma Dokeos 1.8.6.1 © 2010



Campus Uffici regionali ISTAT - Istat — Officina delle Statistiche

Utenti collegati: 6 (4 In questo corso)

Home | Corsi | Profilo | Agenda | Verifiche | Progressi personali | Esci (utullia)

Pagina iniziale > Elaborati

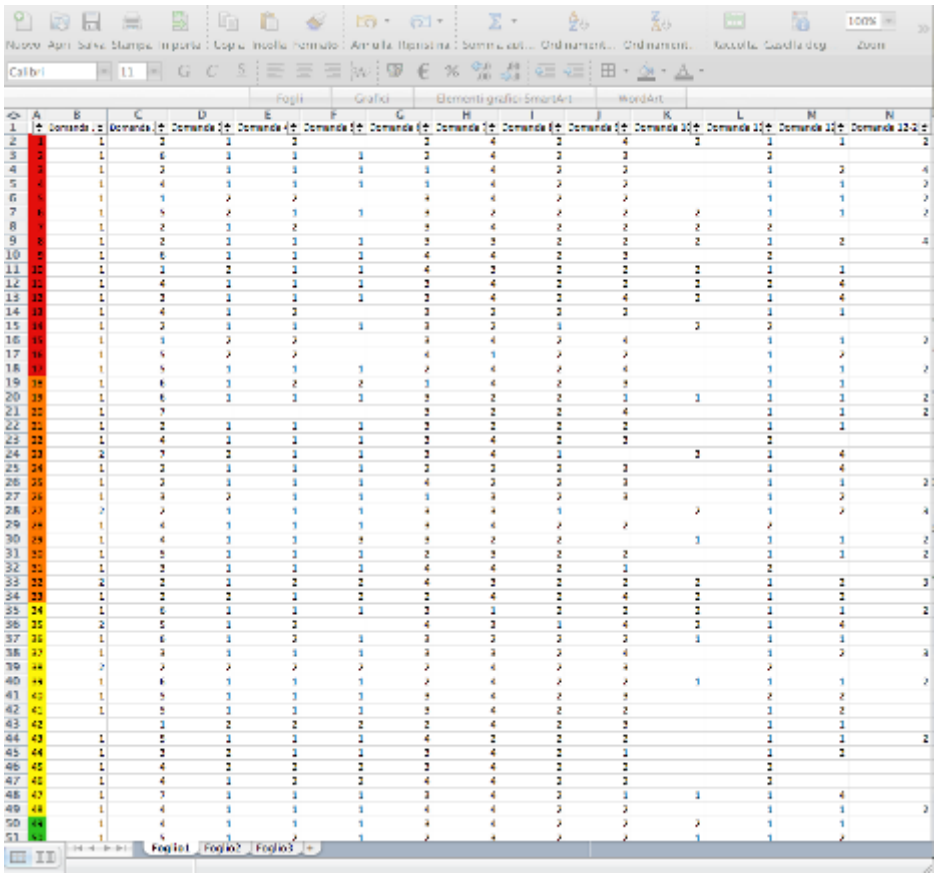
Questa pagina consente ad ogni corsista o gruppo di trasmettere documenti al corso.

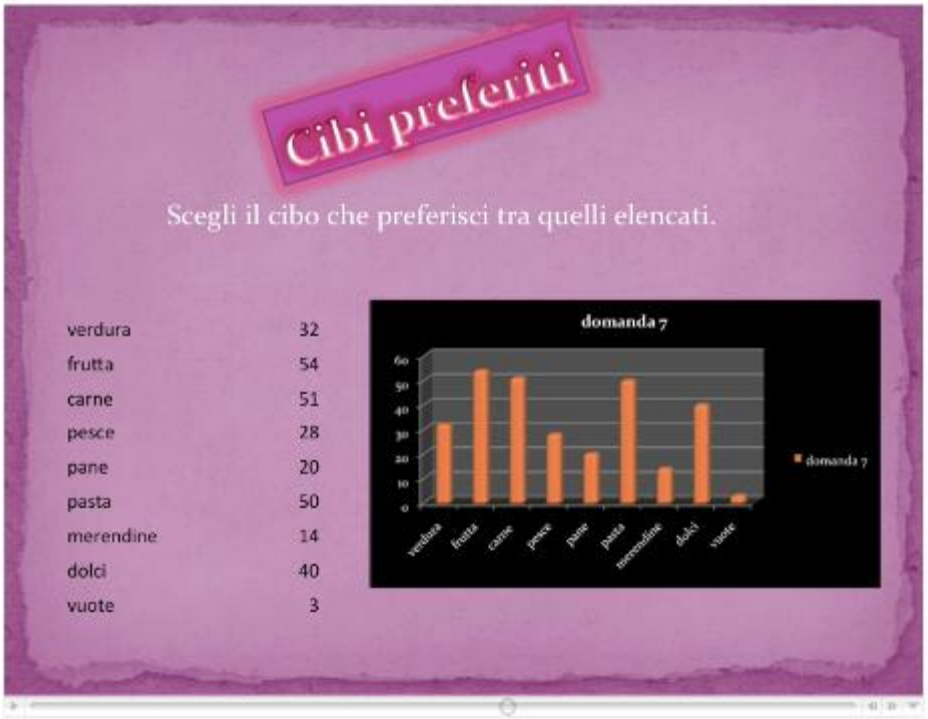
Carica un documento

1 - 13 / 13 — 1 / 1

Tipo	Titolo ↑	Autori	Data
	questionario_alimentazione_officina_isole.pdf Dal lavoro di brainstorming dei ragazzi e dalla loro elaborazione è stato creato il questionario.	Tullia Urschitz	4 giorni, 16 ore Mar 27 Apr 10 00:33
	primi passi 2A Fermi.doc ricerca nel medio	Lucia Emanuela Matta	1 mese, 5 giorni Ven 26 Mar 10 17:14
	PRIME ATTIVITA'_classi quarte.pdf resoconto sulle attività relative al primo modulo	Giovanna Carla	1 mese, 4 settimane Mer 03 Mar 10 19:52
	OFFICINA DI STATISTICA brainstorming.docx abitucini alimentari	Vanda Sarais	2 mesi, 3 giorni Gio 25 Feb 10 22:35
	OFFICINA DI STATISTICA2.zip Presentazione1 modificata	Giovanna Carla	2 mesi, 1 giorno Dom 28 Feb 10 12:58
	OFFICINA DI STATISTICA.zip presentazione1	Vanda Sarais	2 mesi, 1 settimana Mer 17 Feb 10 19:02
	Officina di statistica..docx lezione N°1	Vanda Sarais	2 mesi, 1 settimana Lun 15 Feb 10 20:03
	La conoscenza del collettivo.zip presentazione2	Vanda Sarais	2 mesi, 1 settimana Ven 19 Feb 10 15:21
	istat classe 2.doc	Luisa Orrù	1 mese, 2 settimane Dom 14 Mar 10 16:47
	gruppo_2_FERMI.zip power point 2° gruppo ragazzi Scuola Fermi: la statistica	Lucia Emanuela Matta	1 mese, 5 giorni Ven 26 Mar 10 17:30
	gruppo_1_FERMI.zip power point gruppo 1 ragazzi scuola Fermi: la statistica	Lucia Emanuela Matta	1 mese, 5 giorni Ven 26 Mar 10 17:26
	brain storming 2A Fermi.doc le curiosità dei ragazzi della 2 A Fermi	Lucia Emanuela Matta	1 mese, 5 giorni Ven 26 Mar 10 17:13
	Bozza_questionario_quarte.doc Avvio attività secondo modulo classi quarte	Giovanna Carla	2 settimane, 2 giorni Mer 14 Apr 10 22:45

1 / 1




Cibi preferiti
Scegli il cibo che preferisci tra quelli elencati.
verdura 32
frutta 54
carne 51
pesce 28
pane 20
pasta 50
merendine 14
dolci 40
vuote 3
domanda 7
60
50
40
30
20
10
0
verdura
frutta
carne
pesce
pane
pasta
merendine
dolci
vuote
domanda 7

Robotics and rocketry

Target groups
Lower secondary school – middle school (11 – 14 years old)

Key competences
communication in the mother tongue
mathematical competence and basic competences in science and technology
digital competence
learning to learn
social and civic competences
sense of initiative and entrepreneurship

Aims
awareness of the need for saving water
developing the ability to create graphs, charts
developing the ability to program robots
creating the simple construction of a rocket
proceeding according to the instruction

Duration
2-4 hrs

Place
2 parallel classrooms / one class in two different days

Short description of the activity
Introduction
The students get familiarizedwiththe problemof thescarcityof drinkingwaterin the world by means of asimpleexperience-everyone getsacup of water, some students get a cup of salty water some a cup of fresh water. The value of salty water in cups to the fresh water should beclose tothe percentageof drinkable and salty water sourcesin the world. Organizing an expedition toMarsinorderto findnewsources ofdrinkable water-dividing the classinto two teams.

Main part
Parallel classes/ The class is divided into two groups:
rocket constructors-they create a simple rocket following a simple instruction and make distance tests. They check the maximum distance that their rocket can make. Secondly, they compare their outcomes and display them by means of a bar graph.

Engineers programming robots- programming robots by means of a computer program in order to make a sequence of moves. They display graphically the way made by the robot.

With tasks completed, the students exchange their graphs by means of an interactive whiteboard. The rocket group receives the robot group's graph and the other way round. Their task is to read the graph and work out the data displayed by means of them

Final part and evaluation
Whole class work-the exchangeof conclusions about working withgraphs, charts,other types ofdisplaying data, discussion on the need tosavewater

Evaluation
constructing and reading data displayed by means of a being able to compare them
constructing a rocket, programming a robot
teacher and students chat on the need to save water

Materials / Resources
interactive whiteboard
Lego Mindstorms kit
white paper, glues, scissors, straws, pens, tape
cups with salty and fresh water

School subjects/areas
mathematics (robot programming, creating and Reading graphs and charts, comparing the outcomes),
social studies (ecological thinking, building empathy)
ICT

Short theoretical background (if applicable)
In case that the activity/approach was developed in the frames of particular method, project, etc.

INTRODUCTION (brainstorming)

Prepare cups with salty and fresh water and give one cup/each student. Some students get a cup of salty water some a cup of fresh water. The value of salty water in cups to the fresh water should beclose tothe percentageof drinkable and salty water sourcesin the world. Organizing an expedition toMarsinorderto findnewsources ofdrinkable water-dividing the classinto two teams.

ACTIVITY 1

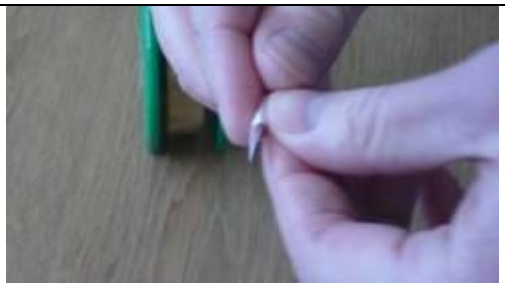
MAKING A PAPER ROCKET
Rocket constructors

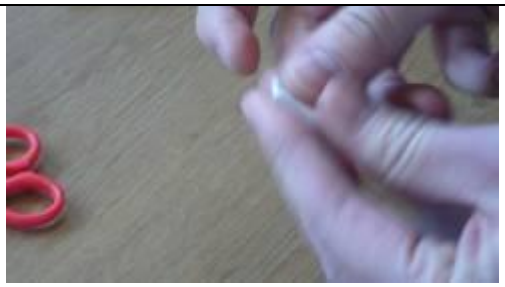
Duration
two hours lesson: the first to build the rocket, the second to draw a graph and analize results (statistics).

Activity description
Take a paper strip and roll it around a pen.

Tape it so it do not fall apart.

Make three paper triangles and fold as shown.





Remove the rocket off the pen, fold one of the side down and tape it.

Now you are ready to take the straw inn and SHOOT
(Before you shoot it you can write a message.)

How far does it fly? Mesure flight lengths and draw a diagram! What can you observe?

ACTIVITY 2

MISSION TO MARS TO FIND WATER
Engineers programming robots

Duration
two hours lessons: the first to program, the second to draw the graph.

Activity description

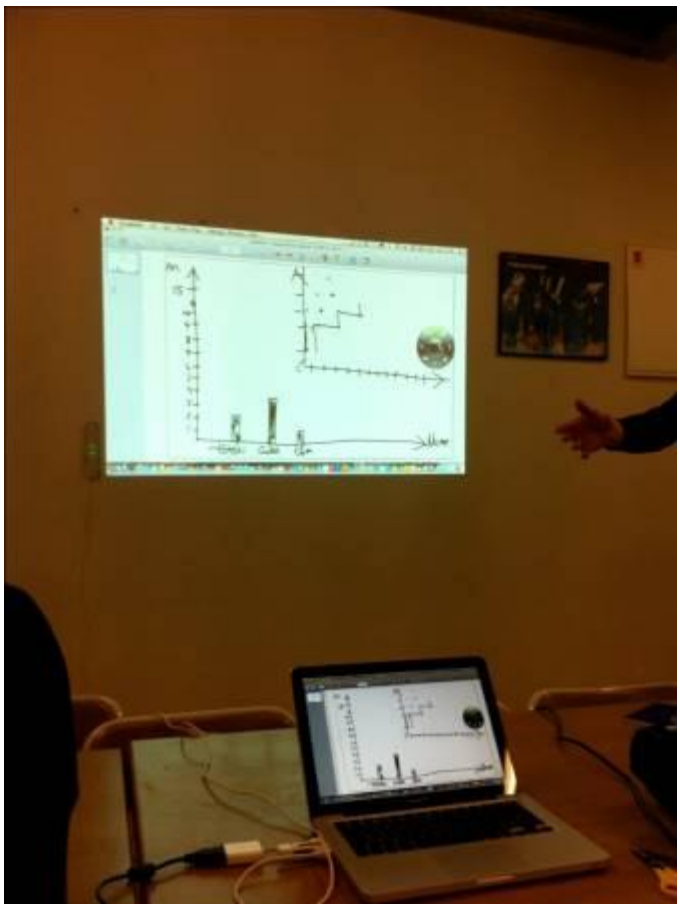
Introduction
Our robot have to find the water on Mars. We can move robot forward, backward and turn left or right, we have only one path possible and we have to follow it.

Icon Instructions: little steps

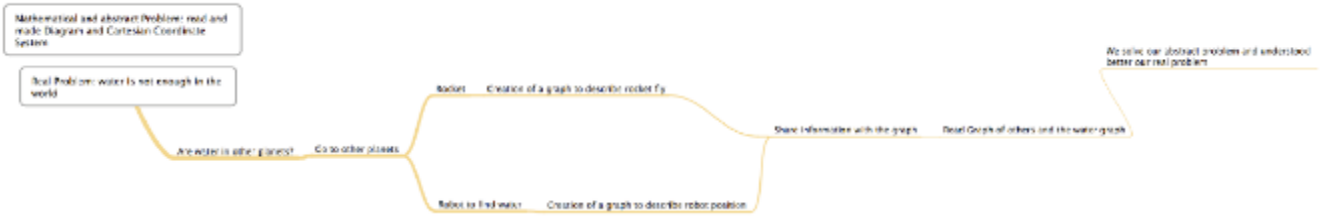
Icon	Control Panel	Direction
		**Forward a step (more or less 17 cm)** **1 rotation= 17 cm forward**
		**Turn 90°**

Create the path of the robot to find water!

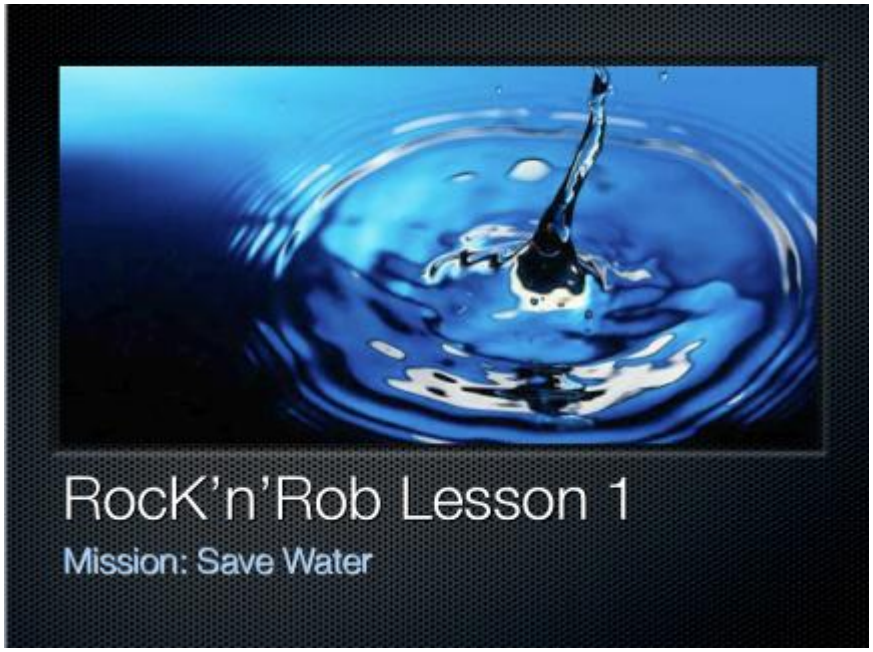
The graph of the movement



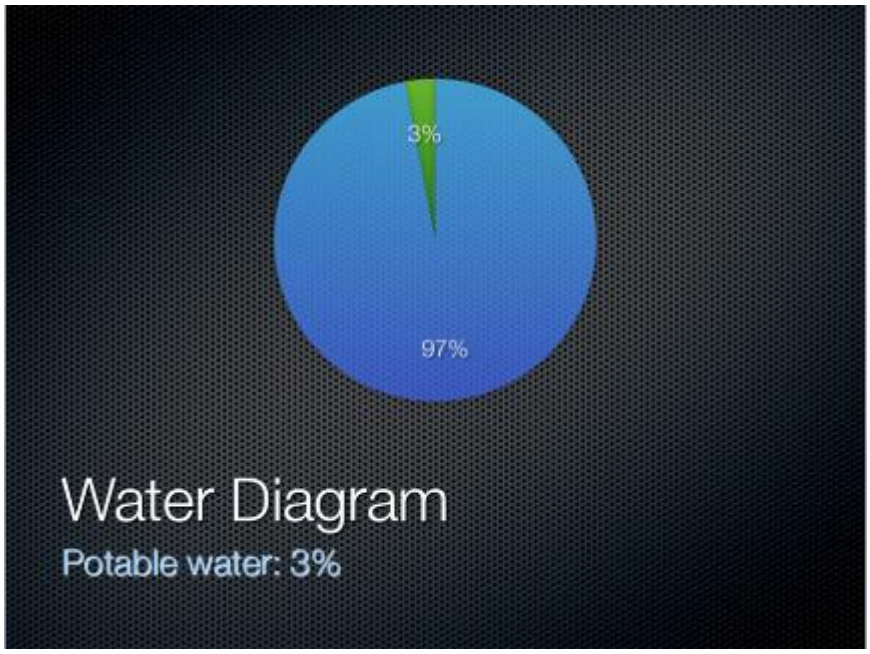
Process Map

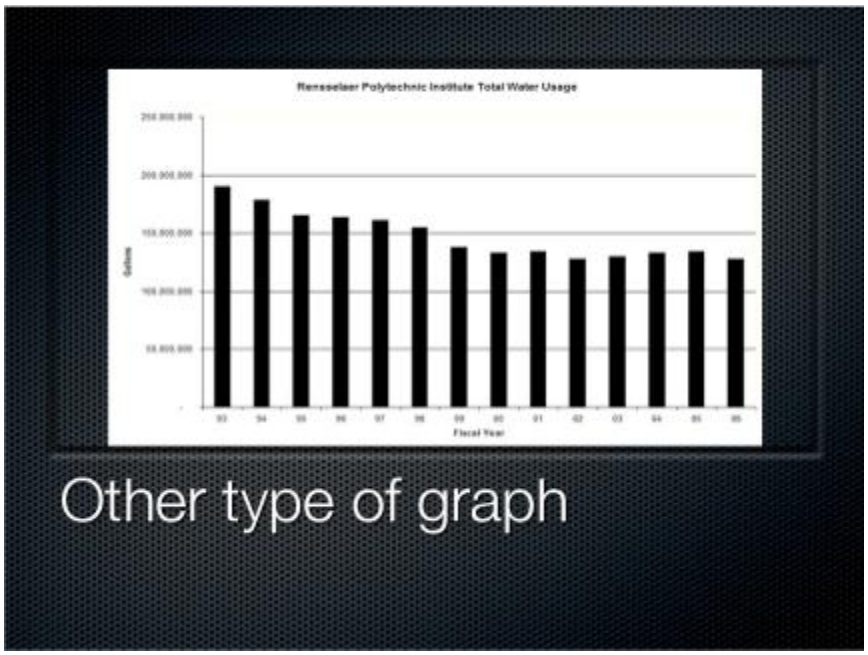

Mathematical and abstract Problem: read and made Diagram and Cartesian Coordinate System
Real Problem: water is not enough in the world
Are water in other planets?
Go to other planets
Rocket
Creation of a graph to describe rocket fly
Robot to find water
Creation of a graph to describe robot position
Share information with the graph
Read Graph of others and the water graph
We solve our abstract problem and understood better our real problem

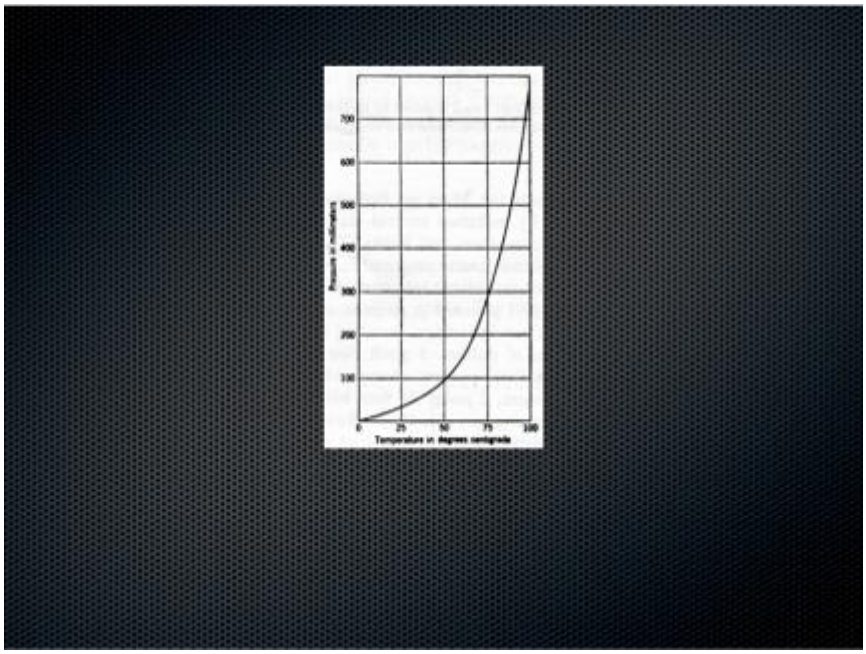
CONCLUSIONS (brainstorming)




Mission to Mars


3%
97%
Water Diagram
Potable water: 3%


Rensselaer Polytechnic Institute Total Water Usage
Gallons
Fiscal Year
Other type of graph


700
600
500
400
300
200
100
0
25
50
75
100

"There is nothing softer and weaker than water,
And yet there is nothing better for attacking hard and strong things.
For this reason there is no substitute for it."

(Laozi, Tao te ching)

Amusement park

Title of the activity / method	Amusement park
Target groups	Elementary School students (third-sixth grade)- 9/12-year- olds Secondary School students (first-third grade)- 13/15-year-olds
Aims	• Providing students with educational skills based on problem solving as well as on using activities that develop and support creativity • Developing a routine of being economic and of controlling personal finances • Raising awareness of where money come from and how to manage them efficiently • Teaching the function of money in market economy • Developing the skill of conscious participation in a discussion • Creating the skill of budget planning and budget balancing as well as decision making and investing skills • Developing self-planning and organizing skills • Fostering the skill of expenditure planning • Introducing basic terminology connected with economy and personal finances • Developing financial decision making skills and the ability to assess their consequences • Teaching various ways of multiplying, investing and dividing one's own finances • Teaching different forms of creating money streams independent of the regular incomes
Key competences	• Mathematical competence and basic competences in science and technology • Digital competence in choosing and using knowledge and skills in a specific area of digital technology • Competence in realizing and analyzing problems so as to find solutions to them • Learning to learn • Social and civic competences • Sense of initiative and entrepreneurship
Duration	Flexible/ depending on the module chosen: up to few months
Place	Any classroom

Short description of the activity	**FUNNYLAND/ Amusement Park** Pupils design and manage their own town. They receive information about the entertainment, the entrance costs and other additional costs of running an amusement park. Pupils' task is to organize the park so that after a year of its activity it would yield as huge profit as possible. Later students will test ones own knowledge playing the game Rollercoaster Tycoon. Detailed description of exercises please find below under the main table.
Evaluation	• At the end of the whole project, pupilscheckeach otherwhoearned the highestannualprofit, collectivelywonderingwhatcouldbe thereason forthe highest andlowestincomesin each ofthetheme parks. They could discuss particular strategies and try to choose the best one. • The knowledgegainedwhile workingon a projectstudentscanuse playing the computer gamewhich is asimulation of amusement park. Gamecan also bea continuation ofwork onthe project, then thetaskof studentsmaybeachievingthe highestincomesin3 months, gaining thehighestpopularity or the greatestnumber of awards.
Materials / Resources	• a computer game- Rollercoaster Tycoon - http://www.rollercoastertycoon.com/europe/uk/flash_content/flash_light.html • Helm. J.H., Katz. J.G. ,Mali Badacze. Metoda projektu w edukacji elementarnej' Warszawa (2003), Wyd. CODN
School subjects/areas	Maths, Information Technology, mother tongue-Polish, Art

Short theoretical background (if applicable)	Using various sources of information, gaining knowledge and using it in practice, learning by means of problem solving. Projects can be characterised by students' autonomy to learn and to complete a chosen topic. They set specific aims which they want to achieve as well as questions which they have to answer. There is a time limit for completing the task and a presentation, a performance or a display usually crowns it. Three main project stages organize students and teacher's work and systematizatize the actions. Thus, they make all actions predictable. **STAGE 1**- choosing a topic that is usually suggested by the students often refering to their own interests. **STAGE 2**- preparing a topic schedule. The teacher and the students gather questions which they are going to answer and set the aims of their work. Next, each student sets out to complete his or her task individually. **STAGE 3**- final stage- project outcomes presentation. Verifying questions stated at the beginning of the project and reflecting upon the possibility of further topic realization.

This project is a simulation of running a small company, taking into account various factors affecting its functioning and is designed to teach students economic thinking, planning and taking deliberate action. Students become entrepreneurs and their task is to establish and develop their own amusement park and multiply profits skillfully. Students perform at two levels: economic and logistic.

ECONOMIC ACTIVITIES

Students create a small business plan by calculating the costs of running an amusement park (daily, monthly, yearly costs) and predict the receipts and their own earnings.

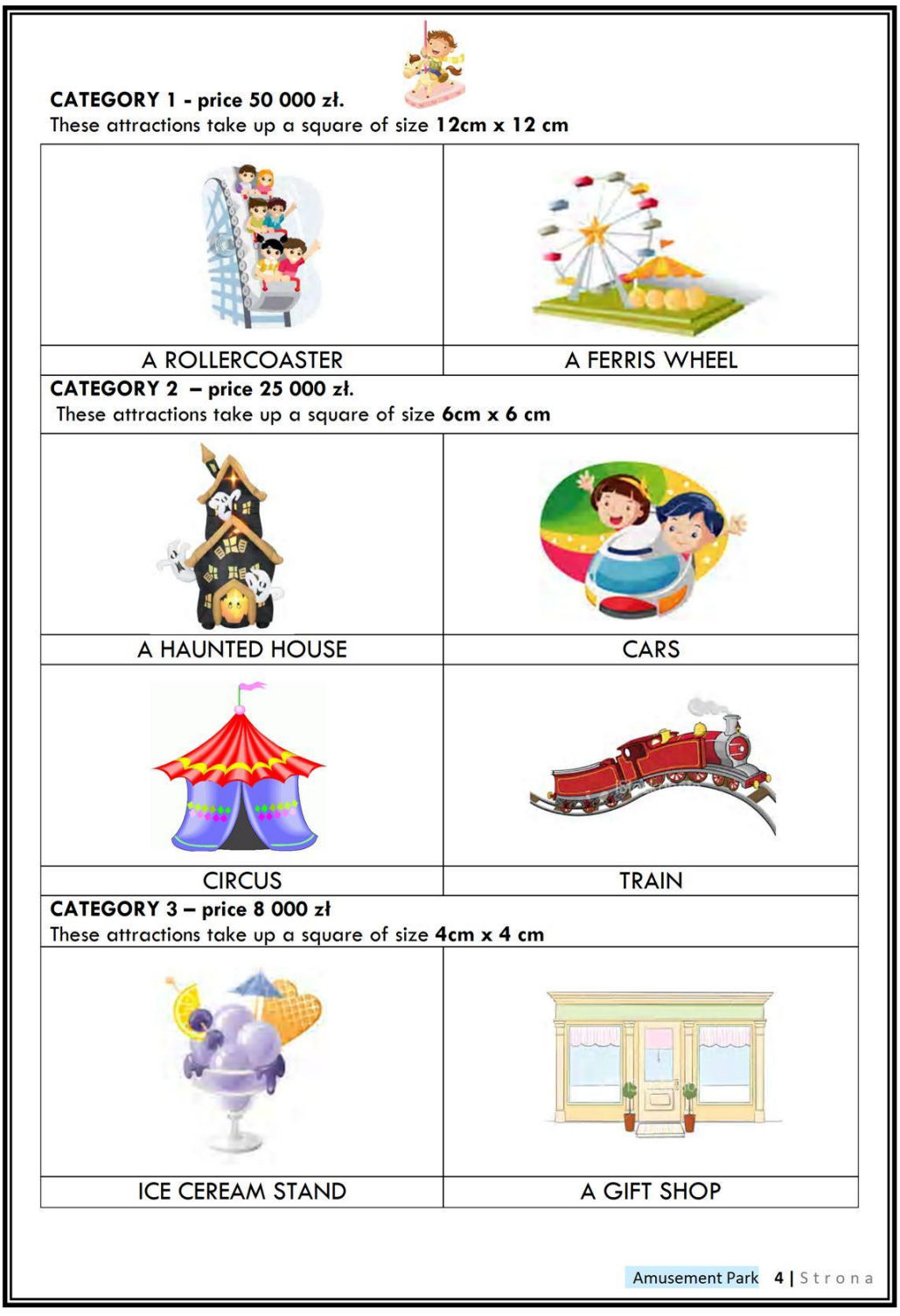
LOGISTIC ACTIVITIES

Creating amusement park models (any technique possible) – distributing attractions and points of service - designing the entire look of the park. Students should pay attention to the desirability of placing paths, toilets, rubbish bins and green sites in their parks.

PROCESS

Students receive a virtual bank loan (each in equal parts). The first activity is the demarcation of the plot (size should be determined in advance, for each participant the same) and reviewing the available attractions – the size, the land occupied, the price per a unit.

1. Calculating the costs of establishing a park - making an inventory of the project - counting all the costs incurred.



CATEGORY 1 - price 50 000 zł.
These attractions take up a square of size **12cm x 12 cm**

A ROLLERCOASTER	A FERRIS WHEEL

CATEGORY 2 – price 25 000 zł.
These attractions take up a square of size **6cm x 6 cm**

A HAUNTED HOUSE	CARS
CIRCUS	TRAIN

CATEGORY 3 – price 8 000 zł
These attractions take up a square of size **4cm x 4 cm**

ICE CEREAM STAND	A GIFT SHOP

Amusement Park 4 | Strona

2. Calculating the daily costs of running a park - the cost of sites' service and other facilities (fixed cost for all), the cost of maintaining buildings and other attractions (fixed cost for all).

Task 2 - **Running your theme park**

To run your theme park the following costs will apply to each item that you have every day. How much will it cost to run your theme park for one day?

DAILY COSTS			
ITEM	**STAFF COSTS**	**ELECTRICIT/REPAIRS**	**TOTAL COSTS PER DAY**
ATRACTIONS CATEGORY 1	40 zł a day	50 zł a day	
ATRACTIONS CATEGORY 2	30 zł a day	30 zł a day	
FECILITY CATEGORY 3	20 zł a day	20 zł a day	
TOILETS	5 zł a day	5 zł a day	
BINS	31 zł 50 gr a week	5 zł 25 gr a week	
TREES	91 zł 25 gr a year	-	
		TOTAL	

Draw a graph to record your costs. Complete this on squared paper. How much does it cost you to open your park for one day?

3. Determining the cost of entry - the costs incurred by guests are the company's receipts.
Ticket price depends on the amount of attractions and the organization of the park and it is evaluated by the person who carries out the project.

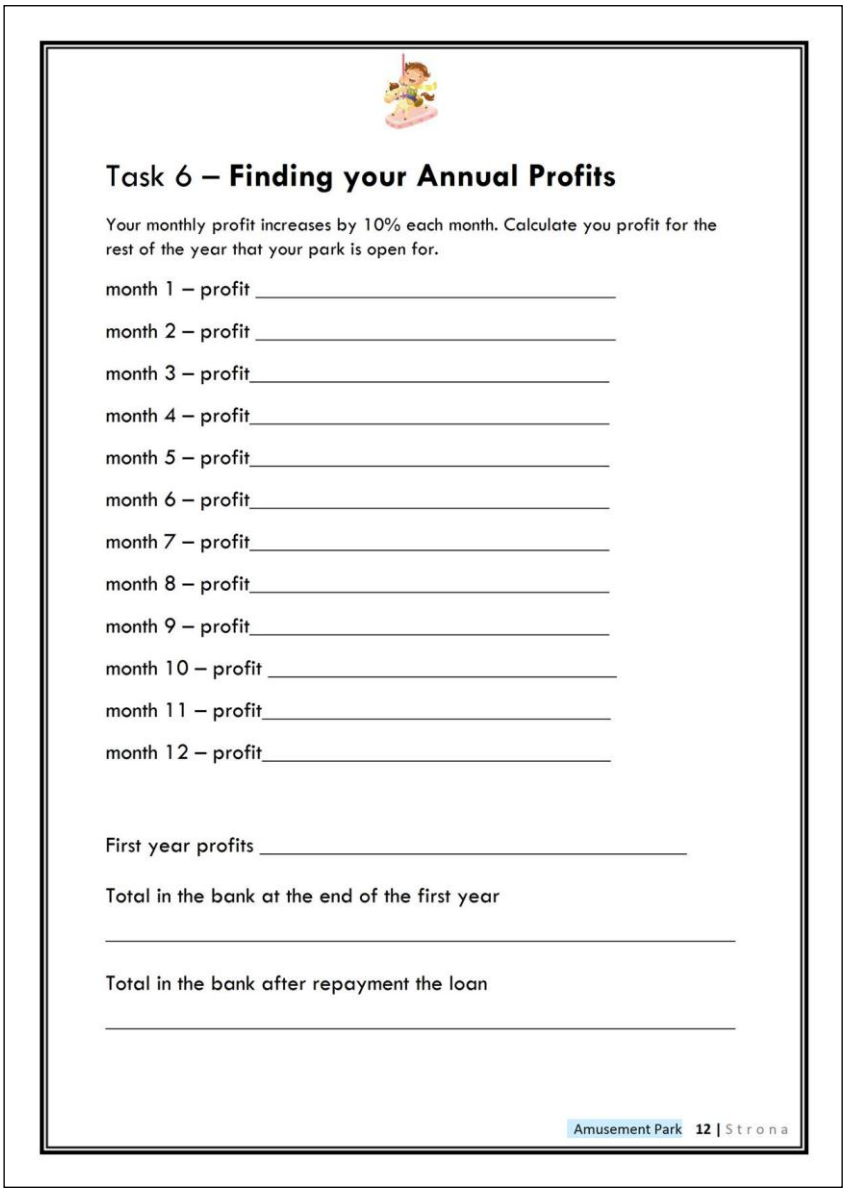
4. Calculating the monthly income from the tickets – for each day of the month there is an approximate number of guests given and students are asked to calculate the monthly income from the tickets.

Task 4 – **How much do you make on the entry fee?**

Calculate how much you make each day based on the entry fee you set on the previous page.

DAY	NUMBER OF VISITORS	PROFIT	DAY	NUMBER OF VISITORS	PROFIT
1	50		16	89	
2	75		17	104	
3	66		18	130	
4	49		19	209	
5	61		20	143	
6	67		21	99	
7	102		22	11	
8	110		23	206	
9	87		24	350	
10	21		25	300	
11	24		26	278	
12	67		27	453	
13	66		28	294	
14	98		29	367	
15	109		30	359	

5. Calculating monthly receipts. Counting the difference between the expenses and the incomes. This is a simulation of receipts on the assumption that every guest in the park spends a certain amount (for example pays the costs of entry, buys a coffee, leaves a certain amount in the gift shop and catering outlets). Calculating the park's income developed during a month of action and the amount of money that will be in the cashbox after paying off a bank loan.
6. Calculating the annual profits with the assumption that each month receipts are rising by 10% in relation to the previous month. Paying off all loans should be born in mind. If the owner receives specific earnings after the first year of running the park, he may also purchase another site and set more modern attractions. Another possibility is to develop the project by allocating some funds foradvertising, innovation, science - bringing more modern attractions.



Task 6 – **Finding your Annual Profits**

Your monthly profit increases by 10% each month. Calculate you profit for the rest of the year that your park is open for.

month 1 – profit _____

month 2 – profit _____

month 3 – profit_____

month 4 – profit_____

month 5 – profit_____

month 6 – profit_____

month 7 – profit_____

month 8 – profit_____

month 9 – profit_____

month 10 – profit _____

month 11 – profit_____

month 12 – profit_____

First year profits _____

Total in the bank at the end of the first year

_____

Total in the bank after repayment the loan

_____

Amusement Park 12 | Strona

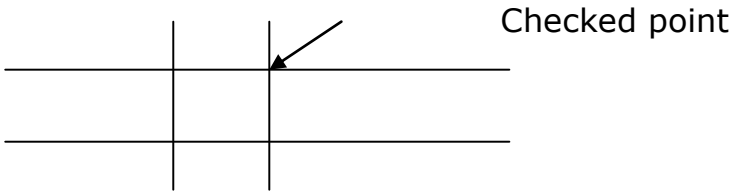
Pick formula

Title of the activity / method	Pick Formula
Target groups	Children in the age of 11-15.
Aims	Teach logical thinking, team work, time management, looking for easier solutions of difficult examples.
Key competences	Communicating in mother tongue, Math, Science, learn how to learn, team work.
Duration	2 hours
Place	Classroom
Short description of the activity	Students revise formulas of geometrical figure areas, make calculations. Teacher shows students new formula which makes calculations easier as long as figure is drawn on checked paper.
Evaluation	Verify hypothesis Students realise importance of mathematical inventions.
Materials / Resources	Checked papers, pencils, rulers, worksheets.
School subjects/areas	Math, drawing, history
Short theoretical background (if applicable)	Pick's formula helps to shorten the time of calculations. This activity focuses on major skills, which students should develop- materials and time management.

Pick's formula ($P = W + 0,5B - 1$)
P- figure area
W- amount of checked points inside the figure
B- amount of checked points exterior of figure

Aims: Developing the ability of logical thinking, team work, time management, as well as teaching how to create new formula and what to do to proof it's validity.

Description: Revising geometrical figure area formulas, learn Pick's formula, introducing of new unit: „checked point''



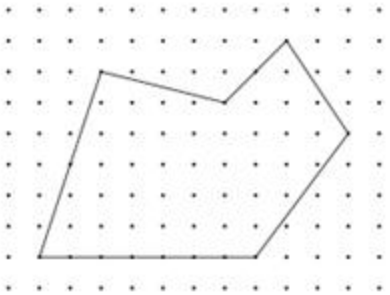
Team – work, make calculations, comparing results.

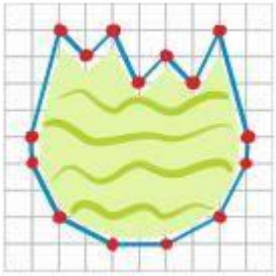
Skills and key competences:

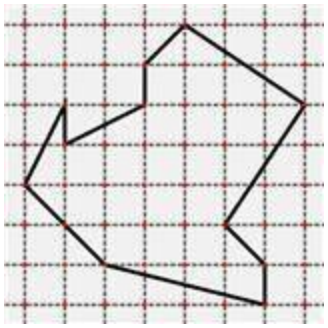
- Communication in the mother tongue
- Communication in foreign language (the activity can be easily translated)
- Maths, science & technology
- Learning to learn

Management: This activity works best with students working in groups of 2 or 4 people.

Materials:
Checked papers
Pencils
Rulers
Worksheets with basic geometricl figures







Procedure:

• Step 1: The activity starts with a short discussion about geometric figure area formulas, show students ‘’checked point’’ (interior, exterior).

• Step 2: Divide students into groups. Groups are given instructions based on which they make calculations by two different ways (regular formula and Pick’s formula). Exchanging worksheets and compare results.

• Step 3: Groups creates drawings to each other and make calculations by two ways. Students control the time.

• Step 4: Discussion- Pick’s formula helps to make calculations of many geometrical figure areas much more easier when you put them onto checked paper. Teacher asks students to find more information about George Pick and his science achievements.

From pebble to penny

Title of the activity / method	**….From a pebble to a penny….**
Target groups	Elementary School students (third-sixth grade)- 9/12-year- olds and Secondary School students (first-third grade)- 13/15-year-olds
Aims	• - Providing students with educational skills based on problem solving • as well as on using activities that develop and support creativity • - Developing a routine of being economic and of controlling personal • finances • - Raising their awareness of where money come from and how to • manage them efficiently • - Teaching the function of money in market economy • - Developing the skill of conscious participation in a discussion • - Creating the skill of budget planning and budget balancing as well • as decision making and investing skills • - Developing self-planning and organizing skills • - Fostering the skill of expenditure planning • - Introducing basic terminology connected with economy and • personal finances • - Developing financial decision making skills and the ability to assess • their consequences • - Teaching various ways of multiplying, investing and dividing one’s • own finances • - Teaching different forms of creating money streams independent of • the regular incomes
Key competences	• - Mathematical competence and basic competences in science and • technology; • - Digital competence in choosing and using knowledge and skills in a • specific area of digital technology; • - Competence in realizing and analyzing problems so as

	to find • solutions to them; • - Learning to learn; • - Social and civic competences; • - Sense of initiative and entrepreneurship;
Duration	Flexible/ depending on the module chosen: up to few months See below for minutes allocated for each module
Place	Classroom Bank Street Depending o the module chosen
Short description of the activity	FROM A PEBBLE TO A PENNY– Bogumiła Szukalska Pupils use different sources, learn about the functions of money and learn to plan and manage own budget
Evaluation	Skillful finance management that leads to the achievement of an aim i.e. a trip financed by self-gathered savings
Materials / Resources	www.ja.org Junior Achievement Inc http://life.familyeducation.com/money-and-kids/parenting/36332.html http://www.moneyinstructor.com/kids.asp http://www.mybudgetplanner.com/MBPkids.htm „ The history of money'' Jack Weatherford
School subjects/areas	Maths, Information Technology, History
Short theoretical background (if applicable)	Using various sources of information, gaining knowledge and using it in practice, learning by means of problem solving. Projects can be characterised by students' autonomy to learn and to complete a chosen topic. They set specific aims which they want to achieve as well as questions which they have to answer. There is a time limit for completing the task and a presentation, a performance or a display usually crowns it. Three main project stages organize students and teacher's work and systematizatize the actions. Thus, they make all actions predictable. STAGE 1- choosing a topic that is usually suggested by the students often refering to their own interests. STAGE 2- preparing a topic schedule. The teacher and the

	students gather questions which they are going to answer and set the aims of their work. Next, each student sets out to complete his or her task individually. STAGE 3- final stage- project outcomes presentation. Verifying questions stated at the beginning of the project and reflecting upon the possibility of further topic realization. Key-

The **"From a pebble to a penny"** project is designed to familiarize children with the history of
money, its power and meaning in life and the economy. It consists of four modules:

I
The origin of money
Discussion of issues related to the direct exchange of goods and services (barter)
Clarification of the functions of money as a means of exchange

In this module, I suggest creating a simulation game such as taking each participant to
cyberspace and each has got only one spare object .....(''Barter economy'')

BARTER ECONOMY
Each student draws one transaction from the supporting material and must make an adequate
exchange.
Instructions
Imagine that at night each of you has been moved to another planet and you carry only one spare
object with yourself. When you look around you can see other people you don't know. You
wonder how to organize your life on this planet. Think about how you can come into possession
of the things you need at the moment. Follow the instructions which you've drawn out.
Transactions
You have got a book - you want to exchange it for a sweater.
You have got a sweater - you want to exchange it for shoes.

You have got shoes - you want to exchange them for a sweater.
You got shoes - you want to exchange them for a mattress
You have got a mattress to sleep on-you want to exchange it for a sweater and a pot
You have got a sweater - you want to exchange it for a pot and a spoon.
You have got a pot - you want to exchange it for a shampoo and a soap.
You have got the shampoo - you want to exchange it for some bread.
You have got the bread - you want to exchange it for 10 litres of water.
You have got 10 litres of water - you want to exchange it for a warm blanket.
You have got a warm blanket – you want to exchange it for some water.
You have got the bread - you want to exchange it for a pocket knife.
You have got a pocket knife – you want to exchange it for a 10-metre rope.
You have got a pocket knife - you want to exchange it for some concentrated food.
You have got a rope - you want to exchange it for a mattress.
You have got a pocket knife - you want to exchange it for some bread.
You have got a soap and a shampoo-you want to exchange them for a pot.
You have got a pen and paper - you want to exchange them for a rope.
You have got a rope - you want to exchange it for a pen.
You have got a bar of chocolate – you want to exchange it for a rope.
You have got a rope - you want to exchange it for some sweets.
You have got some apples - you want to exchange them for a bar of chocolate.
You have got a chocolate candy bar - you want to exchange it for some apples.
You have got two fresh rolls – you want to exchange them for a can of Coca - cola.
You have got a can of Coca-cola- you want to exchange it for the fresh rolls.
You have got a can of Coca-Cola – you want to exchange it for a chocolate candy bar.
You have got a bar of chocolate – you want to exchange it for a pocket knife
Observe students' actions. They have got approximately 10 minutes to complete the task. Stop
the exercise after that time and ask what were the transactions or exchanges and how they
happened. What favored the exchange and made it difficult? How would they deal with such
situation in their live
- Where would they get clothes from?
- Where would they get food from?
- How would they pay for the busfare? Etc. .....

Then you may switch to the topic of money creation and to money's role, types and functions.

The causes of the direct exchange inefficiency will be pointed out while summarizing the game.

Secondly I suggest using:
•History of money
•Types of money
• Discussion on the characteristics that should be attributed to the means of payment
• Functions of money

90 minutes is the time frame provided for this module.

II
Personal finances

This module should include:
☐ Planning your own budget
☐ Decision-making regarding the use of one's own resources
☐ Designing one's own budget, assessing its feasibility and benefits

Suggested worksheets:
A) Table of Alternative Cost
B) ''Make your choice''
C) Sophia's Budget (each one is planning its own budget)

A.
Alternative Costs Chart

No.	item	Favorable conditions	Unfavorable conditions

Pupil wants two different things but he/she has got only specific amount of money. Pupil makes a chart which includes favorable and unfavorable conditions. Based on result the student decides which is better or which thing is more needed.

B.
''Make your choice''
Now when students know 'Alternative costs chart' we give them examples of specific situations and they must make their choice.

Make your choice:
Eve has got a little pocket money - 15 zł. She would like to go to the cinema - the ticket costs
13zł. She is also interested in purchasing a new science book which costs 15zł. What she should do?

……
……
Jack likes to play football. He also likes going to the pool.
……
……
Ola wants to go to the disco. She can also do some shopping for her neighbor and receive 10 zł for this favor.
……
……..
Martin has got little time and has to prepare for tomorrow's History test. He has also agreed to return a book to the library to avoid paying penalty.
……
…….

C. Sophia's Budget
This exercise teaches students to plan personal budget.

PERSONAL BUDGET

Income	Expenses	Suggested changes
Savings		
.....	.....	.....
.....	.....	.....

Total
Surplus .....
Deficit .....

This module should deal with such concepts as:
☐ Opportunity Cost
☐ Surplus
☐ Deficit
☐ Recurrent expenditure
☐ Income
☐ Bare necessities
☐ Discretionary goods
☐ Luxury goods

Different budget types should be discussed when summarizing this module.
45-90 minutes is the time frame provided for this module.

III

Financial management

Concepts:
• Bank
• Bank account

In this module students should go on a trip to a bank in order to obtain as much information as
possible, forms, flyers, etc. on the basis of which all concepts will be explained and a discussion
may be possible.

180 minutes is the time frame provided for this module.

IV

I have money so I can buy.

Concepts:
• Consumer rights
• Pre-payment, earnest payment, loan
• Guarantee, reclamation
• Advertising

Suggested materials:
• Information on the ad (the impact of advertising on our decisions)
• Various examples of behavior in situations related to purchasing which should be useful tips
for successful shopping (worksheets)
• Creating a list of useful tips

A representative of Consumer Federation or Consumer Club can be invited to classes.

90 minutes is the time frame provided for this module.

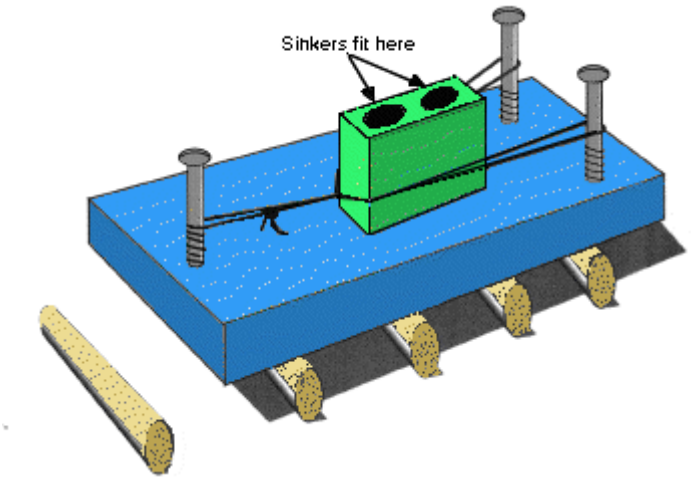
Newton car

Title of the activity / method	Newton car
Target groups	10-15 yrs
Aims	Constructing a **Newton car** in wood.
Key competences	3: Mathematical competences and basic competance in science and technology, by measuring different parts to compose a newton car. 5: Learning to learn. By constructing a mechanic car, testing it`s function, converting it with different kind of wheels 7: Learning activities about the way a mechanic car works in order to understand Newton`s 2.law.
Duration	1 hrs + precuting wood.
Place	UiS, Space camp Turkey.
Short description of the activity	Measuring, cutting, building the car, constructing it. Testing th by adjusting the rubber band, constructing wheels in order to r friction.
Evaluation	Dialogue with students and teachers; meetings and contact with teachers.
Materials / Resources	
School subjects/areas	Physics, Technology
Short theoretical background (if applicable)	• Practical skills combined with theoretical knowledge. • Howard Gardner`s theory on multiple intelligences. Variety of teaching methods to reach the same goals.

Ref:
http://www.reachoutmichigan.org/funexperiments/agesubject/lessons/other/newton_car.html
http://www.nasa.gov/pdf/153412main_Rockets_Newton_Car.pdf

Objective: To demonstrate Newton's Second Law of Motion by showing the reaction of a rolling car by increasing its mass and acceleration.

TOPIC: Propulsion
Description: In this activity, students test a slingshot-like device that throws a wooden block that causes the car to move in the opposite direction.
EDITED BY: Roger Storm, NASA Lewis Research Center



Materials and Tools:

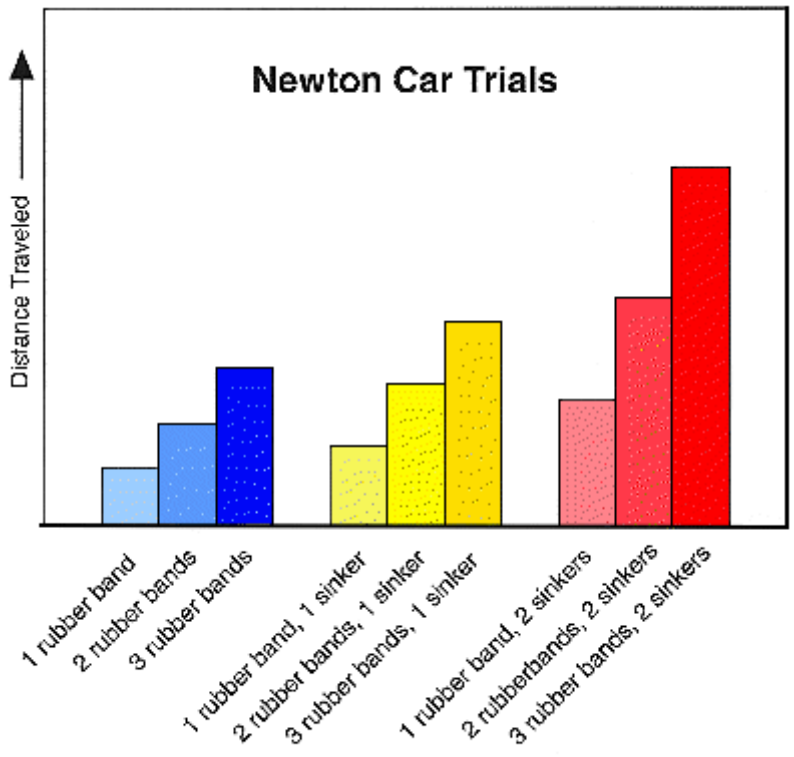
- 1 Wooden block about 1Ox2Ox2.5 cm
- 1 Wooden block about 7.5x5x2.5 cm
- 3 3-inch No. 10 wood screws (round head)
- 12 Round pencils or short lengths of similar dowel rods
- 3 Rubber bands
- Cotton string
- Matches
- 6 Lead fishing sinkers (about 1/2 ounce each)
- Drill and bit (bit size determined by the diameter of the fishing sinkers)
- Vice
- Screwdriver
- Meter stick

Procedure:

- Screw the three screws in the large wood block as shown in the diagram.
- Hold the short piece of wood with a vice and drill two holes large enough to drop two sinkers in each.
- Tie the string into several small loops of the same size.
- Place one string loop over a rubber band and then place the ends of the rubber band over the two screws on one end of the large wood block. Pull the rubber band back like a slingshot and slip the string over the third screw to hold the rubber band stretched.
- On a level table top arrange the pencils or dowel rods in a row like railroad ties. Be sure to mark the position of each dowel rod to make the experiment exactly the same way each time it is tried. Place the large block on one end of the row so that the tips of each single screw

points toward the other dowel rods. Slip the small block (without sinkers) into the rubber bands.

- Light a match and ignite the ends of the string hanging down from the loop. When the string burns through, the rubber band will throw the block off the car and the car will roll in the other direction. Measure how far the car travels along the table top.
- Reset the equipment and add a second rubber band. Again, light the string, then measure and record how far the car travels.
- Reset the equipment and try again with 3 rubber bands. Then try again with one rubber band and two sinkers, 4 sinkers, etc.
- Plot the data from each of the experiments on a graph like the one below.
- **Discussion:** The Newton Car provides an excellent demonstration of Isaac Newton's Second Law of Motion. By repeated trials of the experiment, it will become clear that the distance the car travels depends on the number of rubber bands used and the mass of the block being expelled. By adding sinkers to the block, the mass of the block is increased. By adding rubber bands, the acceleration of the block increases. (Refer to the chapter on rocket principles for a more detailed explanation of this law. The cannon and cannon ball example in the chapter is very similar to the Newton Car.)



(Sample graph. Actual student graphs will vary with skill and care in experiment setup and measurement.)

Teaching Notes and Questions:

This activity offers a number of opportunities to combine science and mathematics. Mathematic skills that can be employed include measurement, recording data, plotting data on a graph, and interpreting graphical data.

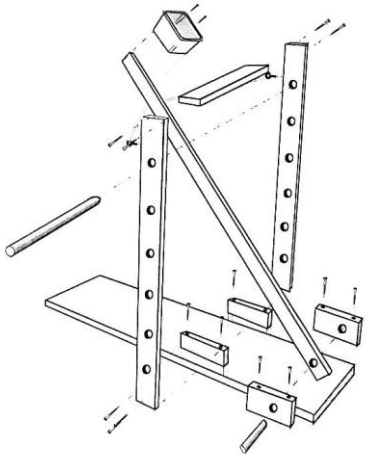
Because this activity involves the use of matches, be sure to exercise proper safety procedures.

Caution: Provide adequate ventilation and a place to dispose of used matches. Scissors can be substituted for the matches but are not as effective. Using scissors requires some practice because the scissors must be quickly withdrawn after cutting the string so as to not interfere with the reaction motion of the car. Permit students to test this principle for themselves by first stepping and then jumping off a stationary skateboard. Observe how far the skateboard travels.

Caution: Be sure to have a student spotter nearby so the student will not get hurt jumping from the skateboard.

Catapult

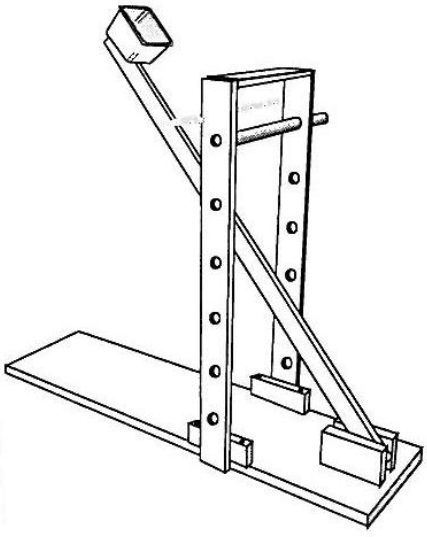
Title of the activity / method	Catapult
Target groups	10-15 yrs
Aims	Experience in constructing their own catapult. Following the procedure. Testing its function.
Key competences	3: Mathematical competences and basic competence in science and technology. Theoretical approaches are used in classroom before and after the practical activities in the science center. 5: Learning to learn: A practical way to demonstrate an old-fashioned invention. Testing in order to demontrate mathematics; statistics and curves. 7: Sense of initiative and entrepreneurmanship: Learning activities about the way a katapult works.
Duration	2 hrs
Place	Science center
Short description of the activity	Use the precutted material to make a catapult. Testing to inspect works.
Evaluation	Dialogue with students and teachers; meetings and contact with teachers.
Materials / Resources	Precutted wodden materials. Carpenter tools.
School subjects/areas	Science and technology. Mathematics. History.
Short theoretical background (if applicable)	• Practical ability, combined with cognitive abilities, by making a copy of an old-fashioned instrument in order to test mathematical functions. • Howard Gardner`s theory on multiple intelligences. Variety of teaching methods to reach the same goals.



Materials:

- 1 basis plate 80x20cm
- 2 side supporters 45x70x2cm
- 4 support wodden blocks
- 1 topp plate
- 1 throw stick 100x4x2cm
- 1 round axle 30cm
- Screews or nails
- 1 plastic box
- Elastic band, or rope.

We used precutted wooden material as menthioned above.



The ready made catapult
Use carpenter tools to put it together. Adjust the elastic band by testing how far it shoot small bits of clay.
References:
http://www.skolelab.ntnu.no/dokumenter/bygg_en_katapult.pdf
Matematics:

http://www.kodex.no/documents/Vibrukerkatapultentilmatematikk.pdf

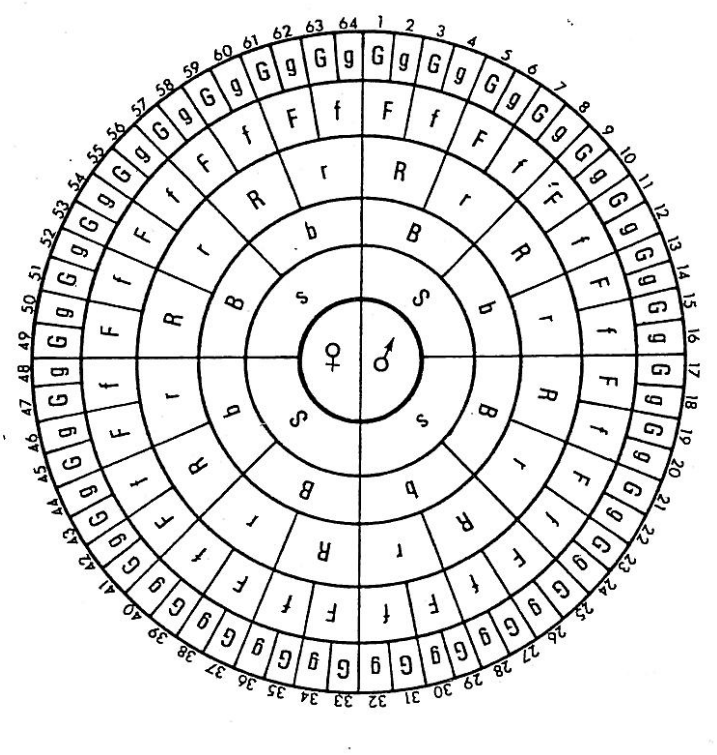
Genetics

Title of the activity / method	Genetic wheel
Target groups	10-15 yrs
Aims	Taste test, combined with genetic mapping of basic physical conditions.
Key competences	3: Mathematical competences and basic competence in science and technology. Theoretical approaches are used in classroom before and after the practical activities in the science center. 5: Learning to learn: A practical way to demonstrate inheritance by observing different physical condtitions. 7: Sense of initiative and entrepreneurmanship: Learning activities about normal inhereted genetic conditions.
Duration	1 hrs
Place	Science center
Short description of the activity	Taste papers with PTC was produced in the laboratorium. Test perso would have to fill in the genetic map for the differentiation of harmle characteristics.
Evaluation	Dialogue with students and teachers; meetings and contact with teachers.
Materials / Resources	Phenyl thio carbamid, blotting paper, genetic map.
School subjects/areas	Biology – genetics. Testing the ability to taste PTC (PhenylThioCarbamid).
Short theoretical background (if applicable)	• Personal experience with theoretical knowledge. Genetic differentiating of individual physical conditions. • Normal variating characteristics in the population.

Objectives
Test to learn about genetic variation.
Learn about dominant and recessive alleles.
Map out variation in single gene traits between themselves and classmates.

Materials
Big genetic wheel
PTC papers
Human traits

The following are considered to be single gene traits – expressions of various combinations of two alleles at one gene locus. Find out if your traits are dominant or recessive and plot them on the genetic wheel to see genetic variation within your class.
Start plotting in the center of the genetic wheel.
Sex, male or female.
The ability to taste PTC (phenylthiocarbamide). S=tasted bitterness. S= no taste
Colour of retina. B= brown eyes. b= blue eyes.
Tongue rolling. R= can roll tongue into a "U". r= can't roll tongue into a "U".
Ear lobes. F= free ear lobes. f= attached ear lobes.
Hear form. G=smooth hear. g= not smooth hear, curly or weavy hear.



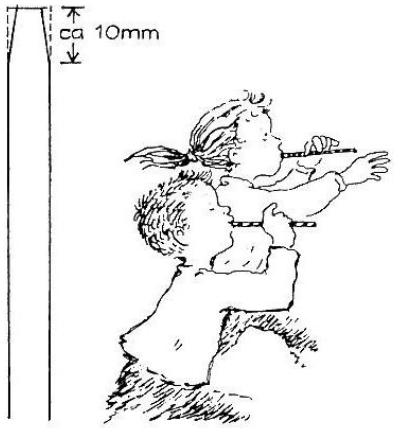
References:

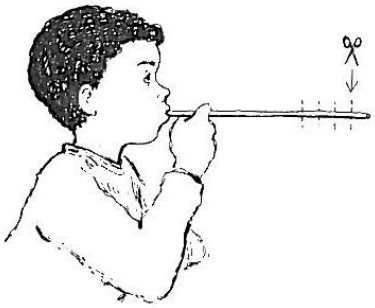
http://en.wikipedia.org/wiki/Phenylthiocarbamide
http://fag.utdanning.no/naturfag/laerestoff_naturfag/forsok/bioteknologi/det_genetiske_hjulet
http://csta.networkats.com/staff_online/staff/uploads/speakers/143_geneticwheel.pdf

Sound – hearing

Title of the activity / method	Sound and hearing
Target groups	10-15 yrs
Aims	Learning about sound and hearing by use of practical examples to explaining difficult concepts concerning the hearing mechanics, leads to a better learning outcome. Construction of different sound objects and methods for testing the hearing mechanism will increase the understanding of the hearing sense.
Key competences	• Mathematical competences and basic competence in science and technology. Strengthening of such competences through practical activities, by measuring the sound speed and sound waves. • Learning to learn: A practical way to demonstrate the hearing mechanics. • Sense of initiative and entrepreneurmanship: Construction of different apparatus for testing the hearing sense, innovate experimental methodology in general.
Duration	2 hrs
Place	Science center
Short description of the activity	In order to fully understand the hearing mecanism, it is necessary to explain the physiological concepts before constructing different sound apparatuses, and practical experiments. Use of tools and instruments to construct sound apparatuses. mathematic to measure the speed of sound. Use of oscillosc demonstrate and watch sound waves. Testing the ability to hear d sound frequencies.
Evaluation	Dialogue with students and teachers; meetings and contact with teachers. Brief account and discussions of the learning outcome. Increasing of practical competences combined with theoretical understanding.
Materials / Resources	Oscilloscope. Different rubber tubes, funnels, cups and threads, tuning forks, straw and glasses.
School subjects/areas	Natural sciences: physics and biology. Technology.
Short theoretical background (if applicable)	Practical skills combined with theoretical knowledge. According to Howard Gardners theory of multiple intelligence the learning outcome increases by stimulating different ways of teaching.

Musical straw:
Flatten the last inch of the straw with your teeth, making sure you don‘t curl the end. Flatter is better. Cut the corners off the straight, flattened end ofthe straw.
Place the cut end ofthe straw into your mouth, seal your lips around it, and blow until a sound is produced. You‘ll feel the entire straw vibrate as the sound is made. Don‘t give up if you don’t make music rigth away, you may need to re-position the straw and tray again.
You’ve just made a mouthpiece, similar to an oboe.
Cut small sections off the bottom of the straw while you’re making the sound. Listen for changes in the pitch as you cut the straw shorter and shorter. Watch for your lips!





Singing glasses:
Fill a wine glass about half full with water. Dip your pointing finger into the water to clean it, use a napkin to wipe off any dirt on your finger and the glass. Set your clean, moist finger on the rim of your glass, press down slightly, and rub it
all the way around the rim without stopping. Keep going in circular motion along the lip of the glass while maintaining the pressure, and, in almost no time, you’ll have displayed a newfound musical talent!

Several things have to be right for a tone to be produced: pressure, moisture, glass type etc. Keep trying because it's worth it. Once you get there, it's hard to stop!

How to use vibrations to move an object:

You'll need to identical wine glasses, water, stick matches or a bits of drinking straw.

Fill each glass with equal amount of water, about half-full seems to work well. Hold the stem of the glass with one hand and dip the index finger of your other hand into the water.

Rest your finger on the rim of the glass, press down slightly, and rub it all the way around the rim without stopping. Keep going in circular motions, - as mentioned above, to produce a tone.

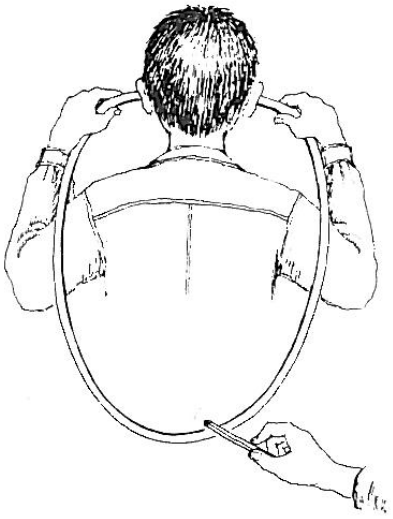
Once you've mastered the art of making the wine glass sing, do the same thing with the other glass. You want the tone from each glass to be the same. This meens that you will need to adjust the amount of water in each glass so that the tone is exactly the same.

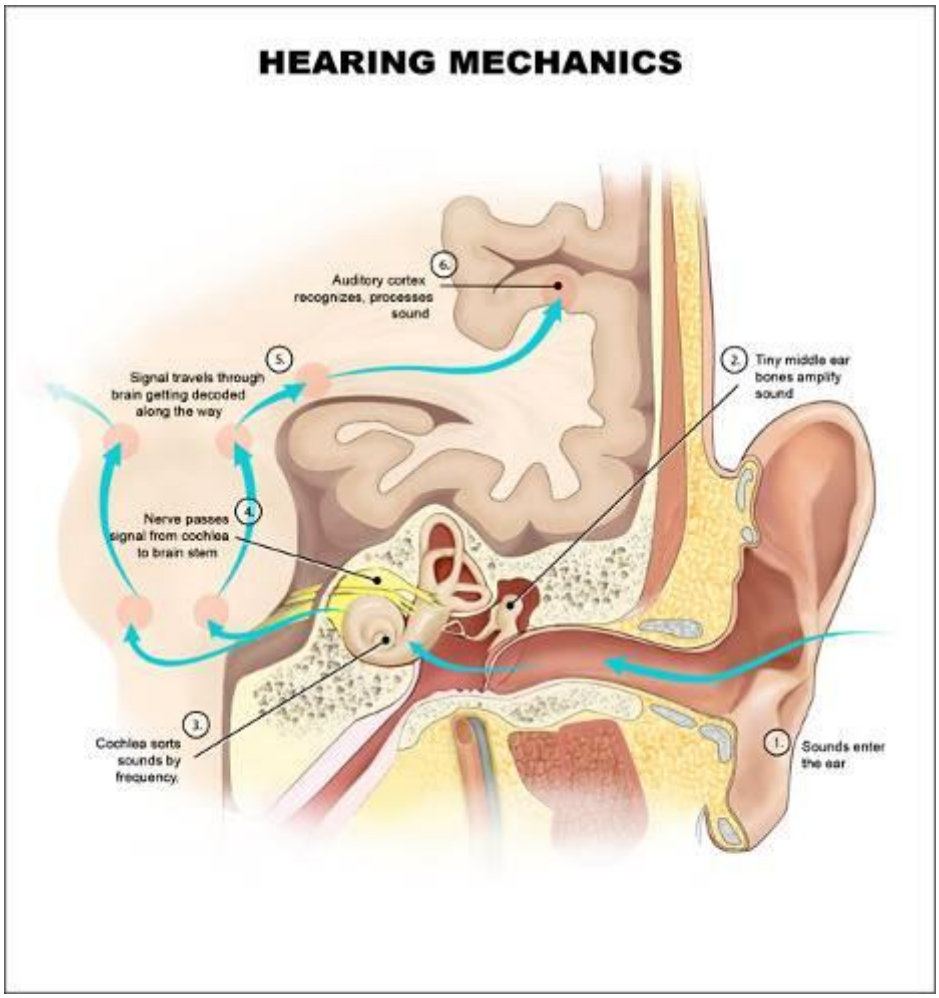
Then comes the fun part: Rest a stick match or bits of straw on the rim of one the glasses. Position the second glass close tot he first one, but make sure they're not touching. Dip your finger in the water and make the glass without the match stick sing, but don't take your eyes off the match. The match moves!

The movement of the match is caused by sympathetic vibrations. The sound waves produced by the glass travel in every direction. When those waves reach the second, the glass begins to vibrate as well and the match moves.

The direction of sound.

Use a 5 – 10 meter long rubber hose. Put a funnel in both ends oft he hose. Hold both ends until each ear. Another person nock at the hose, or put a tuning fork which have been set into vibrations until the hose. The experimental person show where the nock was done; - in the midle, to the left, to the right etc.





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Sound experiments:
http://translate.google.no/translate?hl=no&sl=en&tl=no&u=http%3A%2F%2Fwww.west.net%2F~science%2Fsound.htm&anno=2
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