

# WATER AS AN INDISPENSABLE CONDITION OF LIFE

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***Abstract:** The presentation surveys issues of project education, it outlines targets of environmental projects and shows the basics of mathematic environmental projects. Teachers and students can use tasks during the school year (on walks, trips, during school in nature etc.), demonstrate environmental findings in practise.*

***Keywords:** water, life, projects, environmental education, teaching of mathematics*

## **Introduction**

One of the main objectives of teaching mathematics is to teach students to use theoretical knowledge in practical life. This means that as early as in kindergarten and then grammar school, it is necessary to create such (model) situations in mathematics for the children, which are a true reflection of our surroundings and its environmental problems and which suggest possible solutions by mathematical means in real situations.

Because the Framework Educational Plan which applies to the schools since 2007 and the current students and future teachers will be already teaching according to the approved FEP, it is assumed that schools will devote more time to environmental education, addressing topical issues of contemporary environmental problems of the world not only as separate subjects of environmental education but also within individual subjects (i.e., also in mathematics).

## **Projects with environmental topics**

The newly formulated education tasks for the 21st century put an emphasis on developing all aspects of the personality, so that students understand the world they live in, acquire the knowledge and skills essential for life in a rapidly changing world. They enable the introduction of various new teaching forms in mathematics, especially project teaching.

An important requirement of environmental education in mathematics is linking dispersed knowledge and forming an integrated view on the subject. Mathematics should provide students with a simple and visual means to describe the quantitative

aspects of the world, as we learn in everyday life and other subjects. It teaches to independently observe and describe the surrounding environment and people's relationship to the environment, to obtain and organize information relating to environmental issues, critically consider the knowledge gained in its contexts, infer the possible consequences of various human activities (both positive and negative), encourages creativity, imagination and interest in solving environmental problems. Mathematics thus leads students to actively participate in environmental protection.

To illustrate, here is an example of a mathematical project with an environmental theme.

## **Project: Reflections About Water**

***Project length: 1 week***

***Class: 5-6 grade***

***Task: Water is a condition for life on Earth***

**VVC:**

- Extend the general overview with terms of economic, physical, environmental and mathematical relationships and understanding the relation of these concepts to the real world
- Compare, statistically evaluate these terms
- Mastering statistical skills, like drawing up a table, comparing data, evaluating the best and the worst in relation to the environment, the family budget, etc.
- Understanding the relationships between humanity and nature and the need to keep them in balance
- Application of acquired knowledge and skills in life

**Mathematical goals:**

- Basic arithmetic operations with decimal numbers (comparing, rounding up, writing on a numeric axis, addition, subtraction, multiplication, division) and whole numbers
- Use of decimal numbers in practical situations
- Solving practical verbal tasks using decimal numbers- Repetition of orientation in time

**Inter-subject relations:** Czech language, science, arts, music...

**Motivation:**

Write ten words or phrases that express what you need in order to live. Mark their importance from one to ten. Think about what you could give up. Select only the three most important things in your list and talk about human needs.

**Working with text: Antonín Jiráček – A Treasure**

In a picturesque valley below a high mountain, a small, ordinary village crouched to the ground. One day, little Michael found small translucent stones - diamonds at the foot of mount. The next day all the men went to the mountain behind the village, so that they

too could become rich. They were not interested at all that it has not rained in the past month and the grass in the meadows was dry and arid ground was breaking, that stones peak out from the bottom of the river and the water in the pond dries up. Only the mayor thought hard about how to bring the neighbours to their senses.

One evening he went to the pub and began to talk about the three consecutive days, when his grandfather appeared to him in a dream and always told him: “If you dig between the two oldest lime trees in the village green, you will find great treasure.” The second day since early morning, the villagers dug between the two oldest lime trees like in a race. When they hit rock before midnight, they gave up without further effort. Curiosity drove all to cast their eyes at the glittering gold as soon as possible. Instead, they saw pure spring water, but the mayor assured them: “It is the most precious treasure for the village. We can live without diamonds, but not without water!”

Did you see a well being dug? Describe a situation when a source of water is found. What do you imagine under the word “treasure”? Do you also have your “treasure”? How do you treat it? Are diamonds really more important than water? What were the people in the village like? Try to name their characteristics. If water is “the most precious treasure, we must protect it. Think about how we can protect the water. ... for example by trying to reduce its consumption.

Do you know any spring in your neighbourhood? What is its condition? Would it be appropriate to clean it? Did you notice that throughout nature, water supply often begins to be scarce? Why?

### **Mathematical part**

#### **Motivation**

For a start, solve a mathematical riddle with the children that gives them a hint about the main objective of the project:

12	
8	
13	
14	
9	
15	
8	

$76 - 68 = \dots\dots \mathbf{E}$

$6 + 7 = \dots\dots \mathbf{T}$

$33 - 19 = \dots\dots \mathbf{\check{R}}$

$7 + 9 = \dots\dots \mathbf{P}$

$45 : 3 = \dots\dots \mathbf{M}$

$64 - 47 = \dots\dots \mathbf{R}$

<i>12</i>	<i>Š</i>
<i>8</i>	<i>E</i>
<i>13</i>	<i>T</i>
<i>14</i>	<i>Ř</i>
<i>9</i>	<i>Í</i>
<i>15</i>	<i>M</i>
<i>8</i>	<i>E</i>

16	
14	
9	
17	
10	
18	
11	

$54 : 6 = \dots\dots \mathbf{Í}$

$100 : 10 = \dots\dots \mathbf{O}$

$25 : 14 = \dots\dots \mathbf{U}$

$98 - 86 = \dots\dots \mathbf{Š}$

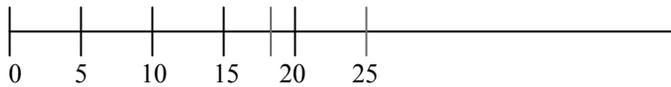
<i>16</i>	<i>P</i>
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<i>17</i>	<i>R</i>
<i>10</i>	<i>O</i>
<i>18</i>	<i>D</i>
<i>11</i>	<i>U</i>

#### **Revision task:**

Think about whether you need to buy bottled water or simply drink healthy water

from the supply system. Estimate and then compare the prices of different water bottles. Enter these estimates on a numeric axis, add signs (=, <, >). Round up the price to whole CZK. When you go shopping with your mother, notice the result of your tip.

E.g. Pepsi – my estimation: CZK 25,- mineral water CZK 17,50.



$$\text{CZK } 17,50 = \text{CZK } 18 \quad 25 > 18$$

Mattoni, Poděbradka, Magnesia, tap water, Korunní, Dobrá voda, Kojenecká voda, Bonaqua, Vincentka

**What will I find out from the next tasks:**

How much warm and cold water do I spend in a month?

How much will I pay for water?

How do I calculate the price of warm water?

**What do I need to know:**

Volume unit:  $1 \text{ m}^3$  (1 cubic metre) =  $1\,000 \text{ dm}^3$  =  $1\,000 \text{ l}$

Water and sewerage prices – cold, warm water

**Task:**

The block of flats houses 82 people. The water meter shows consumption of hot and cold water in the period from 1 April 2009 - 30 June 2009. What is the average daily water consumption? How much in average does one inhabitant of the block of flats for cold water, if the water and sewerage charge is CZK 35,- per  $\text{m}^3$ ?

**INVOICE**

Day	Cold water consumption (in $\text{m}^3$ )	Warm water consumption (in $\text{m}^3$ )
1. 4. 2009	487	321
30. 6. 2009	1054	658

*Cold water consumption in 3 months.....567  $\text{m}^3$  (1054 – 487)*

*Warm water consumption in 3 months.....337  $\text{m}^3$  (658 – 321)*

*Total consumption.....904  $\text{m}^3$  (567 + 337)*

*No. of days in the quarter..... 91 days*

*Daily consumption.....9,93  $\text{m}^3$  (904 : 91)*

*Number of people.....82*

*Cold water price per 1 inhabitant.....242 CZK (567 . 35 = 19 845 : 82 = 242 CZK)*

*Daily water consumption in the whole building is 9,93  $\text{m}^3$ .*

*One inhabitant will pay a cold water charge of CZK 242,-.*

**Task:**

Sobek family consumes ca.  $4 \text{ m}^3$  water daily. How much water they approximately consume in 3 months, if we consider that one month has 30 days. How much will they pay for water after 3 months, when water and sewerage charges are CZK 32.50 per  $\text{m}^3$ ?

*Daily consumption.....4  $\text{m}^3$*

*3-month consumption.....4 . 30 = 120 m<sup>3</sup>*

*Payment for 3 months.....120 . 32,50 = 3 900 CZK*

*Sobek family consumes ca. 120 m<sup>3</sup> water in 3 months and will pay approximately CZK 3 900,-.*

### **Environmental experiment**

**Tools:** glass of water, celery stalk, red or blue food colouring

**Instructions:**

1. Trim the bottom of the celery stalk carefully.
2. Drip a few drops of food colouring into the glass of water. Think about it as a pollutant. Watch as it spreads until all the water is coloured. Likewise, pollution spreads too.
3. Put the celery stalk into the glass. Imagine that it is a small tree or another plant, or even a person who drinks water from groundwater sources. Leave the stalk in the glass for several hours.
4. Then, check the stalk. Slice off a piece and see that the polluted water came up into the stem and it is tinted inside.

**Result:**

You will find that contaminated water also “contaminated” the plant. This means that whatever we do with water, we actually do to ourselves and all living creatures. A plant that takes water from the ground will also receive pollution from the water. A person who drinks from groundwater, also consumes pollution. Once the water is polluted, it is too late. We must prevent this in advance!

**Task:**

You are a detective and your task is to trace the hidden water leaks. The secret places are: the walls, dripping taps, leaky toilet tank, a garden hose. How to proceed? If you have a water meter in the house, ask your parents to teach you to read the meter and show you where it is. Then designate a time when nobody is home (no one uses water). You go to the cinema or for a walk. Before you leave, write down the meter reading. When you return, compare the numbers. If they changed, it means that there is water leaking somewhere.

Draw up a chart or table of water leakage and present your findings at school. Do not forget to tell your parents, to prevent further water leakage.

*Place: Cottage in Brtník*

*Day: 25. 4. 2009*

*Time of departure: 14:00*

*Time of return: 17:00*

*Water meter at 14:00: 34567,8 m<sup>3</sup>*

*Water meter at 17:00: 34570,4 m<sup>3</sup>*

*Water leakage: 2,6 m<sup>3</sup> (34570,4 – 34567,8 = 2,6)*

**Task:**

If a dripping tap fills a coffee cup in 10 minutes, how many coffee cups of water are wasted from dripping taps in one week?

<i>Coffee cups</i>	<i>Minutes</i>
1	10
2	20
3	30
4	40
5	50
6	60

*60 minutes = 1 hour*

*No. of coffee cups per day: 144 cups (24 . 6)*

*No. of coffee cups per week: 1008 cups (144 . 7)*

*1008 coffee cups of water are wasted in 1 week. .*

**Ideas for mathematics**

A dripping tap which fills a cup in ten minutes means 12,000 litres of water wasted per year. Nineteen litres of water flow down the drain during one teeth brushing time, 120 litres of water during one dishwashing time.

If we want to drink cold water, it should be put in the refrigerator, not let it flow from the tap. We consume 20 litres of water per minute for a shower while there are about 190 litres for a bath.

Keep records of water consumption per day (washing, brushing teeth, cooking, washing, drinking, cleaning, watering plants, bathing, toilets, pet food). It is possible to reduce consumption? If yes, state how. Think about how to take care of this treasure.

Consumption table:

		Mon	Tue	Wed	Thu	Fri	Sat	sun
WATER	Morning							
	Evening							
	Consumption							

**Riddle:**

In one year, you can save up to 760 litres of water by not wasting it. This amount is sufficient to fill a a) dustbin b) truck, C) swimming pool.

**Conclusion:**

**Confluence of streams**

- Listening, tempo, B. Smetana
- Express music dynamically by conducting the first part of the Vltava piece from the cycle of symphonic poems „My Country“ by Bedřich Smetana.
- Notice how the composer distinguished two different streams of the river.
- Art expression of a musical piece

- drawing, dry pastel, colour mixing, imprint of nature objects

Each person from a pair creates a single source. Draw the river together from the confluence of river streams.

Work at the river, continue in pairs.

Prepare your palette with blue and yellow tempera paint, note the plants that grow around the river. Collect leaves of certain plants, because you will try to mix a green colour corresponding to the leaves. Apply the colour on their vein side and imprint them on the drawing. Create “Stream Shores”.

The rivers are growing and children are trying to mix the corresponding green, print the plants growing around the water, which was painted in class.

### **Debate about water**

- Children search for necessary information in encyclopaedias
- Protection of water sources –we do not wash cars near rivers and streams.

Those of you who have been by the sea have seen how much dirt there is in some places. Do people know that they must not discharge oil, diesel and other liquid waste in it? Why do they have sewers? And somewhere there is a dump right on the coast. Rust and wrecks of old cars. It is awful how some people behave in nature!

## **Cross-curricular topics in Framework Educational Plans**

Cross-curricular subjects in FEP represent current problems in the contemporary world and become an important and integral part of basic education. They create opportunities for pupils’ individual exercise as well as for their cooperation, and they help developing their personality especially in their attitudes and values.

The content of cross-curricular topics recommended for primary schools is divided into topical areas. Cross-curricular topics involve multiple educational areas and allow the integration of their educational content. Thus they contribute to the complexity of the pupils’ education and positively influence the formation and development of their key competencies. The pupils get a chance to build up an integrated view on the topic and apply a broad spectrum of skills.

Cross-curricular topics are a compulsory part of basic education. The school has to include all cross-curricular topics set out in FEP in the 1<sup>st</sup> and 2<sup>nd</sup> level education. However, all cross-curricular topics need not be represented in each year. Cross-curricular topics can be used as part of the educational content of a subject or as separate items, projects, seminars, courses, etc.

Basic education defines these cross-curricular topics.

- Personal and social education
- Democratic citizen education
- Thinking in European and global dimensions
- Multicultural education
- Environmental education
- Media education

## **Environmental education in FEP – cross-curricular topic**

*Environmental - relating to the environment (from English, Environment = living environment).*

*Environmental science is a science of the environment, using knowledge of the scientific field, examines the mechanisms of the human impact on ecosystems, deals with the prevention of environmental pollution and remedy of the damage and prevention of unwanted interference; it also covers environmental conservation, environmental monitoring, use of natural resources, energy management, health care etc.*

Environmental education according to the FEP leads the individual to understand the intricacy and complexity of the relationship between humans and the environment.

- It leads the individual to actively participate in protecting and shaping the environment.
- Provides knowledge, skills, and nurtures the habits necessary for citizens' desirable everyday behaviour towards the environment.
- Fosters collaboration development in caring for the environment at local, regional, European and international level.
- Teaches to communicate about environmental issues, to speak about and rationally defend and justify views and opinions.
- Leads to responsibility in relation to the biosphere, conservation and natural resources.
- Encourages activity, creativity, tolerance, openness and respect in relation to the environment.
- Leads pupils to realize the basic conditions of life and responsibility of the current generation for future life.

## **Conclusion**

The aim of the project method is solve a task that is concrete, it makes sense, it is realistic, based on life and returns to it after elaboration. Work on the project gives students the opportunity to succeed according to their abilities, to cooperate with others and to be beneficial, to experience the feeling of success and the importance of education. Children learn not only for future life, but learn to live right now, at this point in time. They learn to know themselves and others, know their worth and be useful.

Using the project method can overcome the rigidity of stereotyped forms and methods of teaching, detachment from the realities of life, boredom of expert interpretations and memorization learning without context, and the resulting children's low interest in learning. Project learning is a demanding form of teaching which requires a lot of time to prepare and a lot of expertise and organizational skills in the work of the teacher.

## **Literature**

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## VODA JAKO NEZBYTNÁ PODMÍNKA ŽIVOTA

**Abstrakt:** Příspěvek pohlédne do problematiky projektového vyučování, nastíní úkol ekologických projektů a pro ilustraci naznačí námět matematických environmentálních projektů, ve kterých učitelé s žáky mohou na ukázkách určených k realizaci během školního roku (na vycházkách, výletech, ve škole v přírodě aj.) ověřovat i demonstrovat ekologické poznatky v praxi.

**Klíčová slova:** voda, život, projekty, environmentální výchova, vyučování matematiky