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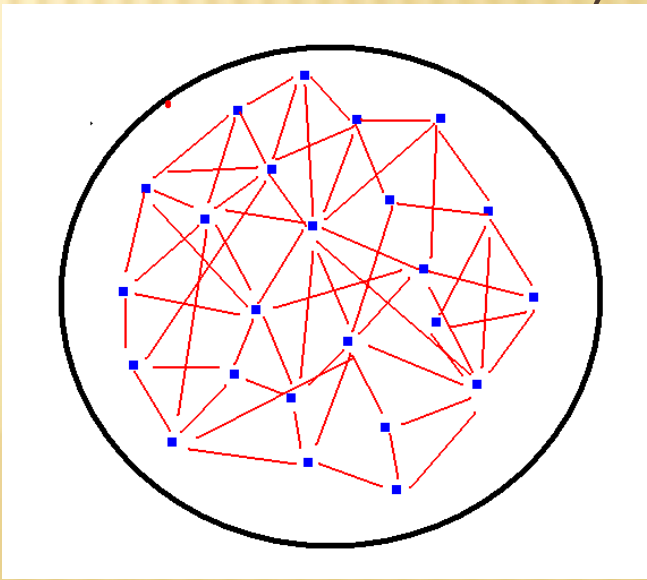
LEARNING TASKS IN THE NATURAL STUDIES TEXTBOOKS AS A TOOL TO DEVELOP PUPILS´ SCIENTIFIC LITERACY

WORLD IS IN THE PROCESS OF CHANGE

- Dynamic and many changes
- Lifelong learning
- School role?
- Content in the text books (dynamic or static?)



CONCEPT OF SCIENTIFIC LITERACY

- Problematic term (more interpretations, concepts, perspectives)
- Bybee, R. W. (1997), Miller J.D. (1983), Laugksh (2000), …
- Understand and use in practical life, make a wise decisions, not only know WHAT, but know HOW WE USE

OECD DEFINITION

- *the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity."*

CHARACTERISTICS OF PUPIL WHO IS *SCIENTIFICALLY LITERATE*:

- Know and understand the scientific concepts and processes required for participation in society
- Ask, find, or determine answers to questions derived from curiosity about their world
- Describe, explain, and predict natural phenomena
- Read with understanding science articles in the popular press and engage in social conversation about the validity of the conclusions
- Identify scientific issues underlying national and local decisions
- Express positions that are scientifically and technologically informed
- Evaluate the quality of scientific information on the basis of its source and the methods used to generate it
- Pose and evaluate arguments based on evidence and apply conclusions from such arguments appropriately

INVESTIGATION – A PART OF SL

- The process is based on the formulation and testing of hypotheses, gathering observable and measurable evidence, organisation and analysis of data. Scientific investigations must be repeatable to allow for the verification of data and to establish reliability of conclusions.

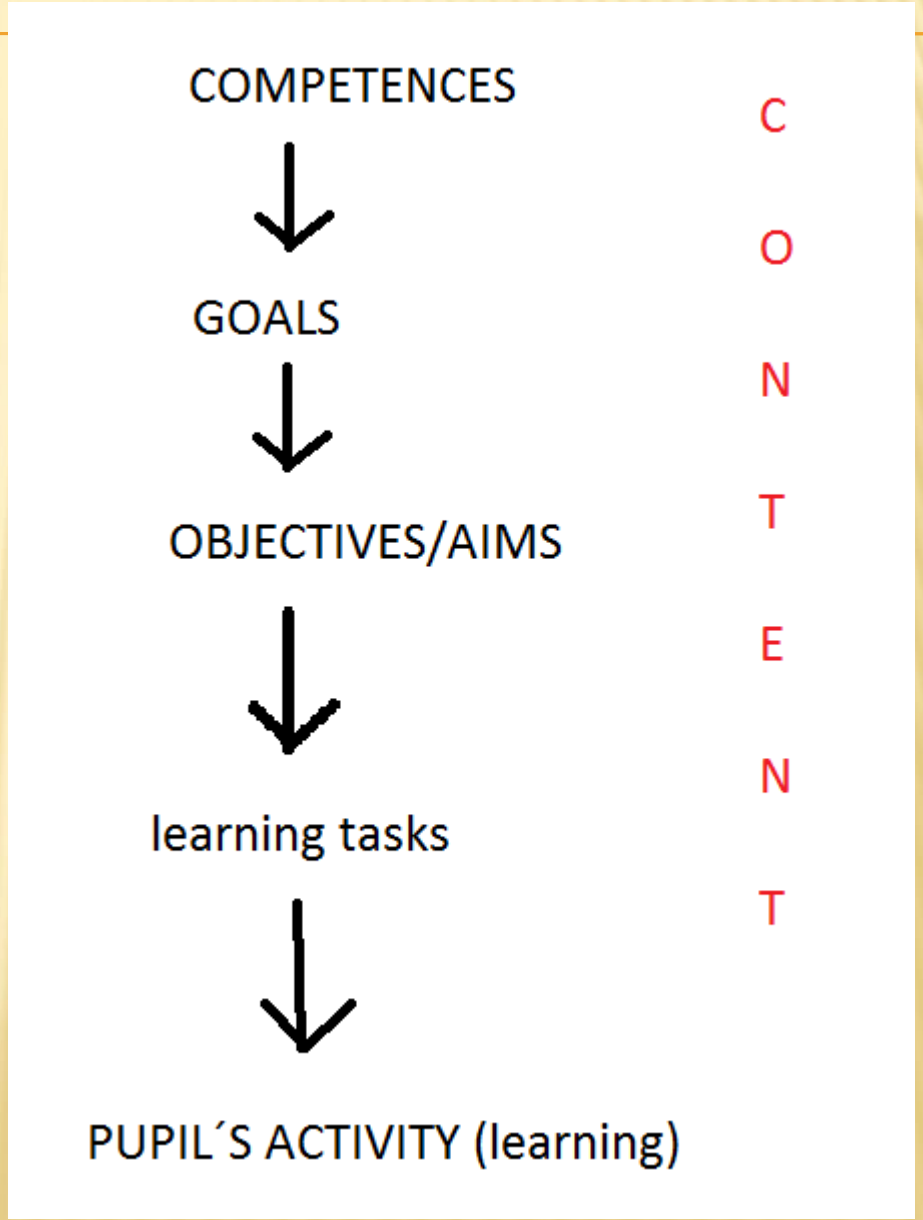
THE PROCESS OF INVESTIGATING SCIENTIFICALLY

SCIENTIFIC LITERACY AND CZECH FRAMEWORK EDUCATIONAL PROGRAMME

- Reform of Czech educational system (from 2007)
- School curriculum
- Concretization curriculum
- taking into consideration conditions of the school

COMPETENCE – GOALS – LEARNING TASKS

- POSITION OF THE
- CONTENT (subject
- matter)!!!
- Teaching/learning
- without content is
- not possible!!!



COMPARISON CONCEPT OF SL AND KEY COMPETENCIES IN THE FEP

The concept of scientific literacy	Competency (FEP)
Active acquiring and use (basic elements) conceptual system science	seeks and classifies information, and having understood, interlinked and systematised it, he/she uses it effectively within the learning process, in creative activities and real life;
acquiring and use of methods and procedures of science empirical methods and procedures (systematic and objective observation, measurement, experimentation)	makes observations and experiments independently; compares the results obtained, assesses them critically and draws conclusions from them for future application;

COMPARISON CONCEPT OF SL AND KEY COMPETENCIES IN THE FEP

The concept of scientific literacy	Competency (FEP)
rational methods and procedures (to formulate conclusions, drawing conclusions, strategies of problem identification	notices the most various problem situations at school and outside of school; recognises and understands a problem; reflects on discrepancies and their causes; considers and plans ways to address problems while employing his/her judgement and experience; solves problems independently; selects suitable ways to solve problems; uses logical, mathematical and empirical methods when solving the problems;

COMPARISON CONCEPT OF SL AND KEY COMPETENCIES IN THE FEP

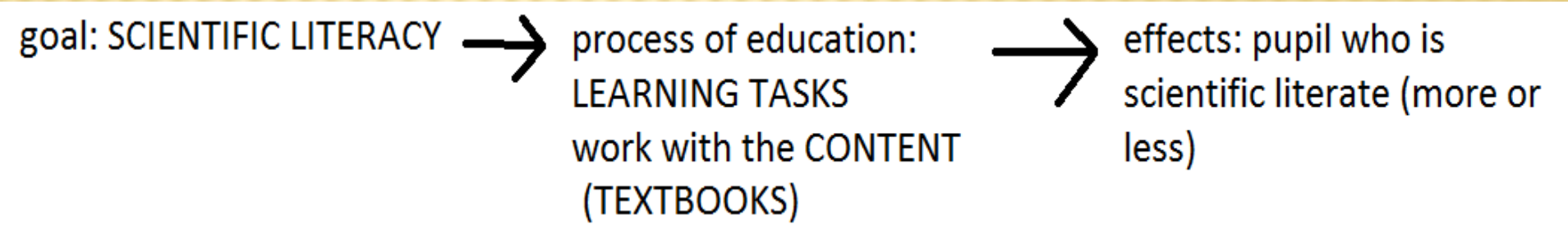
The concept of scientific literacy	Competency (FEP)
Active acquiring and application of knowledge from science	critically assess the results obtained and infers from them conclusions for the future
Active acquiring and use of modes of interaction of science knowledge with other segments of human knowledge or company	uses information and communication means and technologies for quality, effective communication with the surrounding world he/she uses information effectively within the learning process, in creative activities and real life;

LERNING TASK AS A KEY

- Key of support and develop od SL
- LT as possibility to learning
- LT activated pupils
- Learning tasks and questions evoke learning activities of students, which aims to provided learning goals
- Questions as a special typ of LT

LT AND SL

- Learning tasks can be considered as one of the means to achieving the objectives of science teaching and thus scientific literacy.
- SL content active words and LT help pupils to be active



LEARNING TASK IN SCIENCE TEXTOOKS IN PRIMARY SCHOOL

- Teacher prepares LT
- IT technology X textbook
- Both are important and its don´t go against
- Textbook are still as important didactic material (price, older teachers, every pupil have it – also at home)
- Teachers use textbook in preparation teaching plan (managed topics and didactic material)

POSITION OF THE TEXTBOOKS

- "Textbook is a specific epitome of educational program (curriculum), which is not mandatory for teachers or for the content or methodology. Despite the current traditional textbook content respect, differences mainly concern the scope of the curriculum and its methodological design. „ (Maňák, 2005)

TEXTBOOKS AND IT, TEXBOOKS AND LT

- Textbooks as traditional didactic resources and IT technologies
- Teachers are accustomed to use the texbooks, the unavailability of IT (elementary school)
- Textbooks as a model for the formation of a class (the curriculum)
- If teacher use a textbook, then usually use the task too

RESEARCH

- Textbooks for elementary school (a few reserches, focus on content or partial topics, questions- conceptual analysis, i.e. healthy food)
- Compare science textbook in historic view (Podroužek)

OUR RESEARCH

- LEARNING TASKS IN THE SCIENCE TEXTBOOKS – how is the possibility to activated pupil´s?
- What types of learning tasks are represented in the selected science textbooks for elementary school?
- Focus on topic: water
- Science phenomenon which pupils know, use it, part of FEP in CR (subject matter)

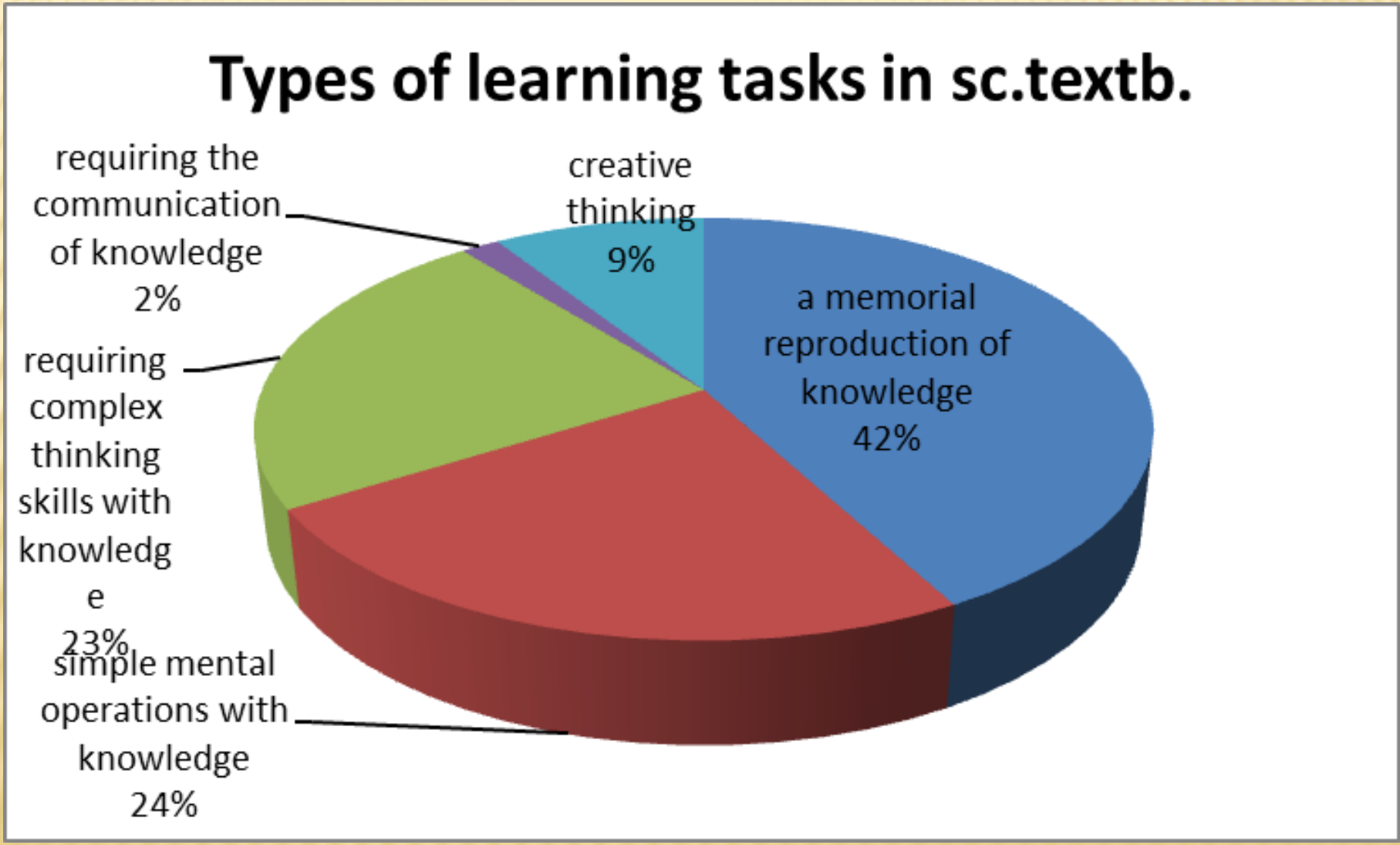
TYPES OF THE LT (TOLLINGEROVÁ, 1986)

- 1) Tasks requiring a memorial reproduction of knowledge (facts, definition)
- 2) Tasks requiring simple mental operations with knowledge (enumarate of knowledge, process, comparison)
- 3) Tasks requiring complex thinking skills with knowledge (evaluation, explanation, rationale)
- 4) Tasks requiring the communication of knowledge (make a news, project)
- 5) Tasks requiring creative thinking (discover by own making, thinking, aplication tasks)
- FROM PASSIVE TO ACTIVE, FROM SIMPLE TO DIFFICULT

THE RESULTS

- 120 LT (in a topic of water)
- Average 15 LT in a one textbooks
- In one textbooks – 0 (topic in another year)
- In second one - 42

GLOBAL RESULTS



Type of the learning task	Abs. frequency	Relative frequency četnost (due to all LT)	Relative frequency četnost (due to cathegory)
1. a memorial reproduction of knowledge	**51**	**42,50%**	
1.1 recognition (Is the Sun a star?)	1	0,83%	1,96%
1.2 reproduction facts, terms	44	36,67%	86,27%
1.3 reproduction definitons	6	5,00%	11,76%
2 simple mental operations with knowledge	**29**	**24,17%**	
2.1 detection facts	11	9,17%	37,93%
2.2 enumerate and describe facts	5	4,17%	17,24%
2.3 enumerate and describe processes	5	4,17%	17,24%
2.4 analysis and synthesis	3	2,50%	10,34%
2.5 comparisons, differentiating	2	1,67%	6,90%
2.6 classification	1	0,83%	3,45%
2.7 survey the relations betveen fact	2	1,67%	6,90%

EXAMPLES

- 1.2 reproduction facts: *Which is the temperature at which water boils?*
- 1.3 reproduction definition: *Characterize the physical state of water.*

LEVEL 1 AND 2

- About 65%!!
- Pupil has to learn a facts, definitions from the textbook (static subject matter)
- But only repeat it
- LT for aplication of knowledge miss there
- Don´t use the knowledge in his life X scientific literacy
- Static knowledge X dynamic world

3 Tasks requiring complex thinking skills with knowledge	**28**	**23,33%**	
3.2 explanation	14	11,67%	50,00%
3.3 extrapolation	4	3,33%	14,29%
3.4 deducing	9	7,50%	32,14%
3.5 verification	1	0,83%	3,57%
4 Tasks requiring the communication of knowledge	2	**1,67%**	
4.1 preparation of information, communicate an information, make a paper	2		100%
5 creative thinking	**10**	9,17%	
5.1 practical aplication	4	4,17%	50,00%
5.4 discovering his own observations	5	4,17%	41,67%
5.5 discovery at its discretion	1	0,83%	8,33%

TASKS FOR AN EXPLANATION: LEVEL 3 - EXEMPLES

- *Why is earth called blue planet? According to the scheme, explain how water circulates on Earth. Can you explain how a lake was formed on the photo? (with a picture of the task 2.5) Why do we have to increase the intake of fluids on hot days or when we have a fever? Why do we have hot days in water the plants more than in the days of the cold? Why do not we pour detergent into the water in the wild? Why not just build houses in close proximity to streams and rivers? Why do not reach the sockets with wet hands? Explain how polluted water can harm humans. Explain why people who were stranded at sea without drinking water supply suffering (dying) thirst. Puddles after the rain dry up faster than (summer - fall). Tell why. Explain why a person should not the used oil to drain into the ground or in their own backyards or on their own garden. Try to explain why and how a mat of water pollution in one part of the world affect clean water should be in a completely different and very remote parts of the world.*

TASKS FOR DEDUCING - EXEMPLES

- What would happen if the oceans are polluted and not protected?
- How it related to the sun with the movement of air and water on Earth?
- First What you pointed out a man who wants to wash the car by the river or a pond?
- Second Tell me, how people are to behave in a label: Caution, water protection zone
- What happens to water that soaks into the soil?
- Think about what is causing spring floods (with a picture of the task 1.2)
- Underground water is always drinkable?
- Could there be life as we know it on Earth?
- What water they can drink shipwrecked at sea? (all three questions only with the attached explanation, or 1.2)
- What would happen to life on earth if the water cycle stopped?
- What could be the cause of stopping the water cycle on Earth?
- What can happen when it rained due to heavy downpour lot of water for a few hours?
- What can cause very heavy or long winter snowfall?
- How water affects plant and animal life?

TASK FOR VERIFICATION

- *Try the simple experiment how fast the water is distributed throughout the body of the plant. Observe how long the ink stained white petals of carnation.*

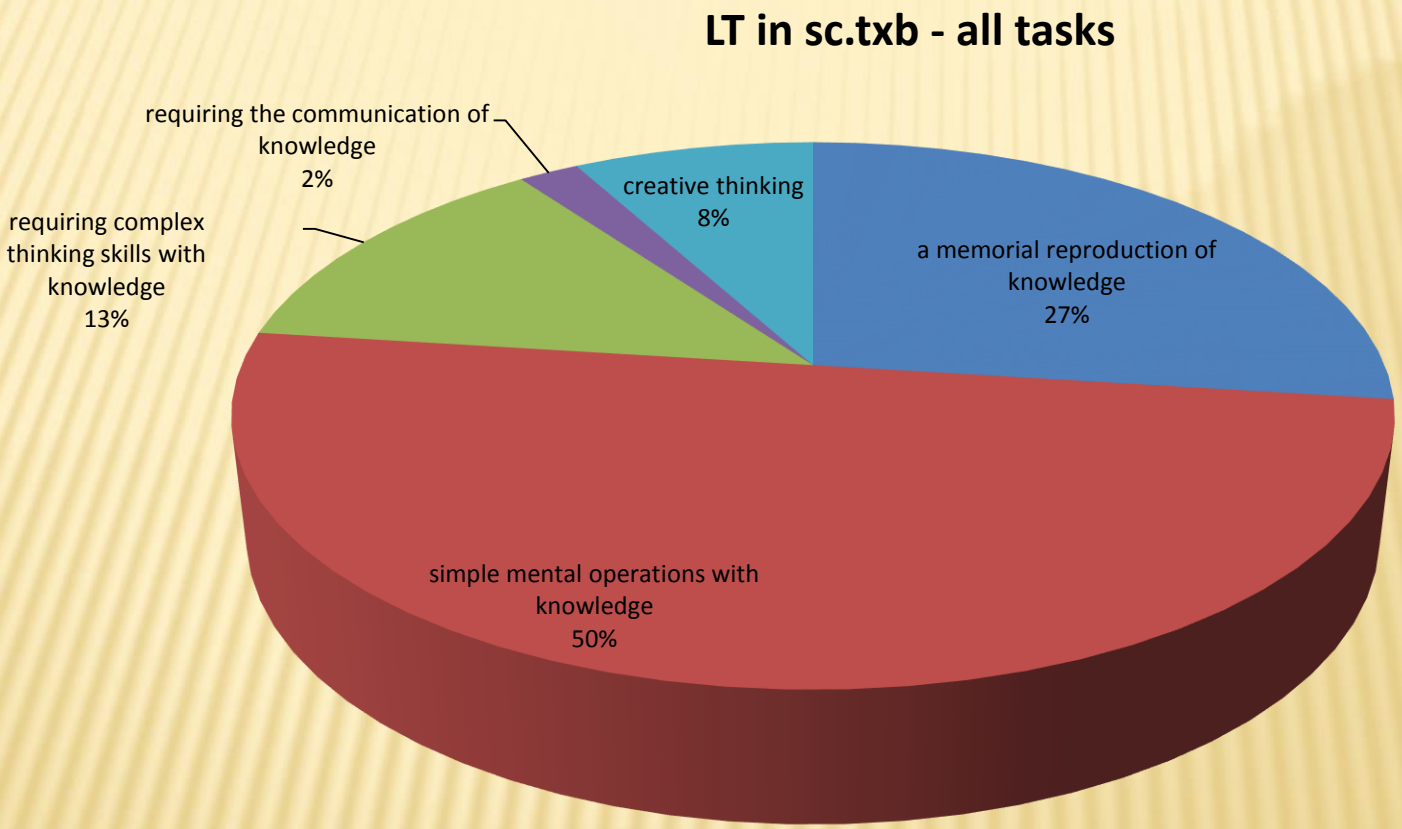
LEVEL 5: CREATIVE THINKING

- Tasks: the **practical application**
- *Try to count how many gallons of water we consume every day.*
- *Suggest how it would be possible to prevent water pollution in rivers and lakes.*
- *Suggest how to supply water to plants in the case of drought.*
- *Discuss how each person can contribute, you therefore, to be sufficient clean water for all?*

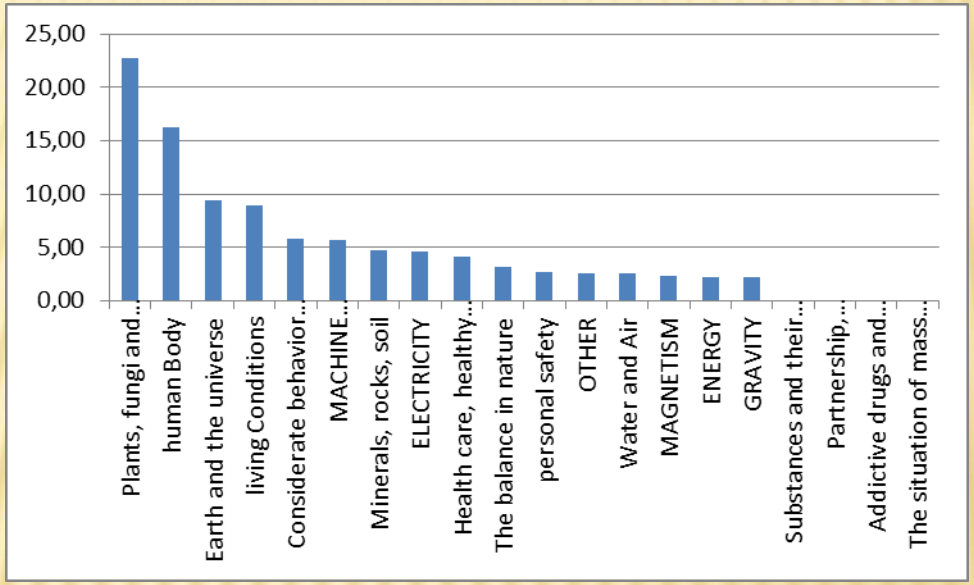
LEVEL 5: DISCOVERING HIS OWN OBSERVATIONS (EXPERIMENTS)

- Find out why the salt can not escape from the water in the oceans. (experiment)
- "Scientific work"
- Exp: to investigate the salinity of the water. Drops of taste and tell what flavor. Taste the water from the tap. It is really sweet (yes - no). What is the taste and color?
- Observe your surroundings in three state waters. Write where you can meet the water in a liquid, gaseous, solid.
- Exp: Change of state of water (water vapor on a hot spot and cold spot). Observe and write down why this is so and where the water "disappear".
- Exp: Condensation of air. Write observation.
- Exp. surface tension. Write in your own words what you observed.

ANOTHER RESEARCH (NOT ONLY TOPIC: WATER)



RELATIVE FREQUENCY OF LEARNING TASKS BY TOPIC IN FEP



STATIC CONTENT (SUBJECT MATTER) AND RELATION WITH SIMPLE LT

- „old“ topics (in the textbooks before 2007)
- „new“ topics (after 2007, reform of educational system)
- LT level 1,2 – in the old topics
- LT level 3,4,5 – in the new topics
- More LT in the old topics
- New topics – relation to real life (p.e. Partnership, parenthood, basic of sex.educ., Addictive drugs and health, The situation of mass threat

THE COMMON FEATURES MORE DEMANDING LEARNING TASKS

- What is possible to observe more difficult learning tasks? Develop SL
- **1) LT are close to the context of pupil life – psychomotoric dimension**
- Thinking about **pupil life context** - where, in what situation the pupil may meet with the issues? How it could be connected with the pupil life experience?

THE COMMON FEATURES MORE DEMANDING LEARNING TASKS

- *2) learning tasks reveal understanding of natural science phenomena around us and develop scientific thinking (especially creative tasks) - cognitive dimension*
- Meaningful tasks (question Why I have to learn?)
- Knowledge about nature and „scientific competences“ – identify of scientific issues, explaining phenomena through science and drawing conclusions based on scientific evidence

THE COMMON FEATURES MORE DEMANDING LEARNING TASKS

- 3) *teaching tasks include motivational tool* - affective dimension - it's not "parroting“, encourage motivation, think of creative tasks.
- How can I motivate pupils (extrinsic motivation),
- motivation - environmental issues, interesting phenomena around us (nature is wonderful)
- *attitudes: expressions of interest in natural science, recognition of the value of scientific research and motivation*

INTEREST AND SCIENCE EDUCATION

- Interest in science decreases because students work with dead dates, repeating algorithms, yet the child is naturally inquisitive, interested to know.

SCIENCE EXPERIMENTS AS A COMPLEX TOOL

- 1) experiment is the **source of knowledge about natural phenomena**, but also a method of gaining knowledge
- 2) greatly facilitates the acquisition subject matter by **increasing pupils' interest** in helping to shape the curriculum and specific ideas about specific scientific concepts
- 3) has a similar function as in science - **the acquisition of new knowledge**, but with the difference that the new findings are only for the pupil
- 4) **contributes to stimulate pupils** in lessons, character learning activity
- 5) contributes to the **development of scientific thinking, observation and technical skills** of pupils

SCIENCE EXPERIMENTS AS A COMPLEX TOOL

- Example cycling - the airflow (the topic of water and air). negative pressure (train, trucks)
- Experiment: ping-pong ball and the airflow – problematic task, motivation, connection with pupil´s life

THANK YOU FOR YOUR ATTENTION

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