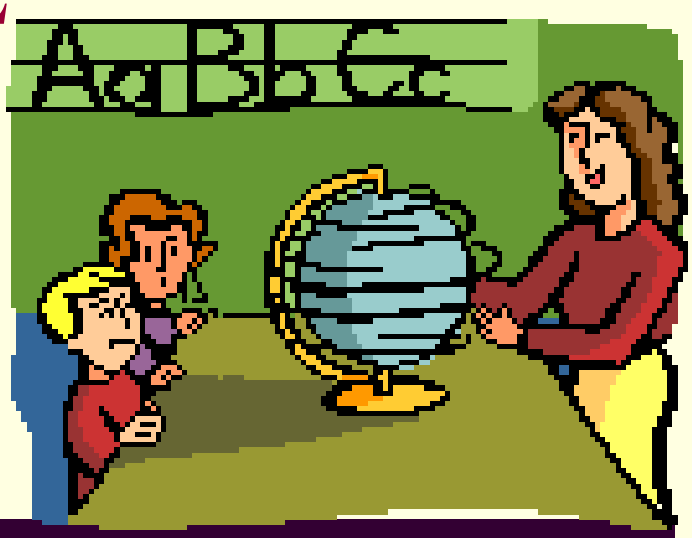
INTEGRATED SCIENCE EDUCATION IN THE CONTEXT OF THE CONSTRUCTIVISM THEORY

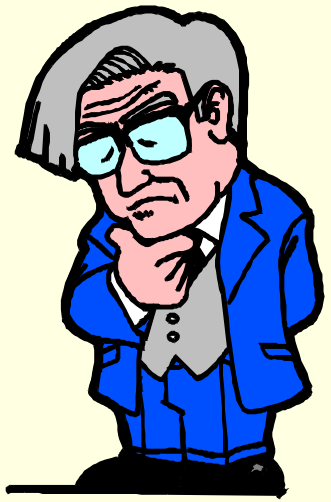


A neutron walked into a bar and asked, "How much for a drink?" The bartender replied, "For you, no charge.“

Heritage language

IN THE BEGINNING

- What is it contemporary constructivism?
- Have you some ideas?
- What are the qualities of constructive science teaching and learning?
- Why is it difficult for teachers to work in constructivist teaching/learning environment?



CONTEMPORARY CONSTRUCTIVISM

- It is obvious that the contemporary constructivism has a lot of varieties (forms):
  - radical;
  - personal;
  - social;
  - cultural;
  - philosophical;
  - physical;
  - evolutional etc.

CONTEMPORARY CONSTRUCTIVISM

- Application of the constructivist epistemology develops preconditions for the transition from teacher-oriented to pupil-oriented curriculum which is realised by considering the leraner`s needs, interests, context by creating the appropriate environment.
- Teaching process should be:
  - Related to learner`s:
    - active performance;
    - Meaningful performance;
    - Constructive performance.

SOME THEORETICAL STATEMENTS

- The theory of social constructivism, which highlights the importance of understanding acquired by the learner, competences as a product of social interaction, acquired when learners are involved in performance based on their experience, in interaction with the environment and in cooperation with the senior who provide assistance.
- The concept of the curriculum, oriented towards the child, society and educational process, which integrates curriculum development, implementation and learner`s experience and determines a holistic approach towards education.
- The concept of the unified curriculum, which highlights children`s personal and social development.

SOME THEORETICAL STATEMENTS

- The model of pedagogical system and educational paradigm change, which focuses on the transition from the traditional pedagogical system to the contemporary ICT-based educational system.
- The concept of educational environment, which highlights its interaction with learner`s infividual learning environments.

TWO MAIN APPROACHES

- “Cognitive constructivism” which is about how the individual learner understands things, in terms of developmental stages and learning styles etc.
- “Social constructivism”, which emphasises how meanings and understandings grow out of social encounters (attributed to Vygotsky).

SOME GENERAL PRINCIPLES

1) Cognition is developed by its subject rather than acquired passively;
2) The function of cognition is adaptive and allows learners to construct vivid explanations of their experience;
3) The process of construction is always related to the social environment the individual is part of

P.S. The increase in the influence of constructivism is determined not only by the acknowledgement of the pupils` need to construct their individual and meaningful cognition, but also by the change of the attitude towards learning/teaching as learners` performance assisted by teachers or other more experienced people.

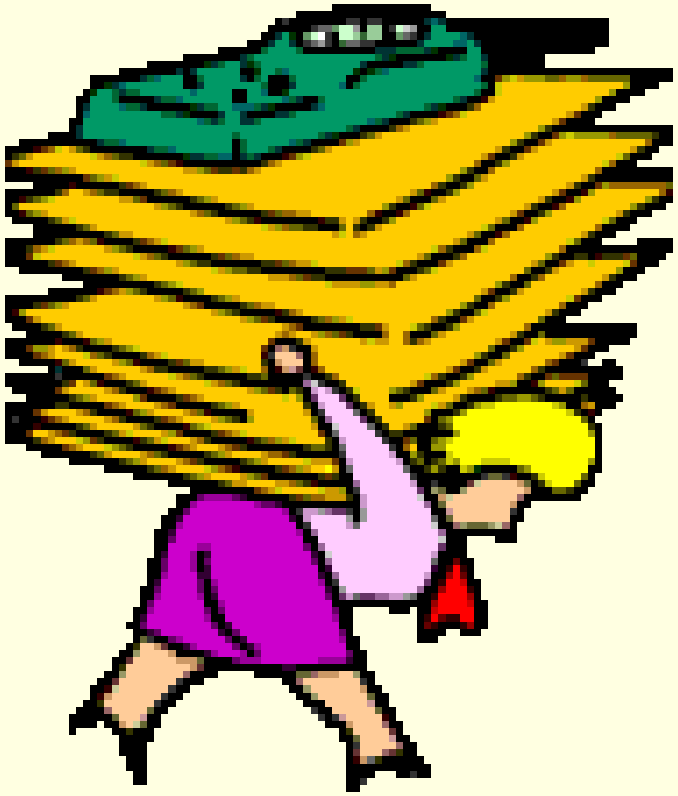
THE FUNDAMENTAL CONSTRUCTIVIST STATEMENTS AND HIGHLIGHTS

1. Learners are treated as social and socially motivated individuals.
2. Teaching /learning is active (as process), autonomous and subjective process of cognition which is not, however, independent from teachers, school, family, friends, other social factors and their context.
3. Teaching/ learning is of social nature, as best learning takes place when information is exchanged among learners, when they cooperate and solve problems together.
4. Constructive teaching/learning is related to individual and group activities.

THE FUNDAMENTAL CONSTRUCTIVIST STATEMENTS AND HIGHLIGHTS

- 5. Active teaching/learning process is the most appropriate for organizing these activities.
- 6. Teaching /learning is related to changes in learners` concepts that affect their former understanding.
- 7. Learning implies the need for ICT-equipped and learning-oriented and empowering educational environment, related to learners` individual learning environments, databases, expert systems.
- 8. Employing learners` personal experience is a necessary condition of constructive learning.

THE INTERNAL CONDITIONS OF IMPLEMENTING A CONSTRUCTIVIST SCHOOL-LEVEL CURRICULUM



- An urgent question is the choice of the most valuable content in terms of a position of education for real life!

CONDITIONS FOR CONSTRUCTING A SSC VISION AND AIMS

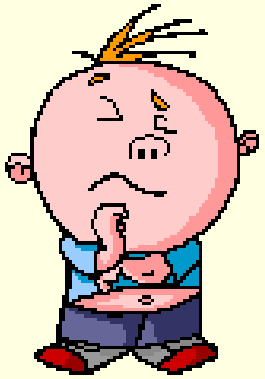
1. All community stakeholders are involved in the working group on a school-level curriculum.
2. Assistance of external experts is employed.
3. Aiming to become a learning organization.
4. Teachers are given more freedom in the field of the curriculum.
5. Complex aims are defined in terms of the desirable competences.

CONDITIONS FOR CONSTRUCTING A CSC CONTENT

1. Team work is exercised.
2. Integrated programs are used.
3. Pupils` needs for self-expression are satisfied.
4. Program for developing an ICT infrastructure has been prepared.

CONDITIONS FOR ORGANIZING A CSC PROCESS

1. The characteristics of learning-oriented timetables have been considered.
2. Provisions for active learning strategies have been made.
3. Regulations on accreditation and assessment of pupils` prior informal and self-directed learning and self-study have been made.



CONDITIONS FOR CSC IMPLEMENTATION, MONITORING AND EVALUATION

1. Evaluation of teachers` activity in terms of CSC implementation (employment of constructive teaching/learning strategies and methods, cooperation, development of ICT-intensive educational environments, etc.).
2. Development and application of formative holistic system of monitoring and assessment.

THE SPECIFICITIES OF INTEGRATED NATURAL SCIENCE EDUCATION

- **What knowledge for what life?**

Two methodological principles

Assessment, specialization, differentiation, dissolution

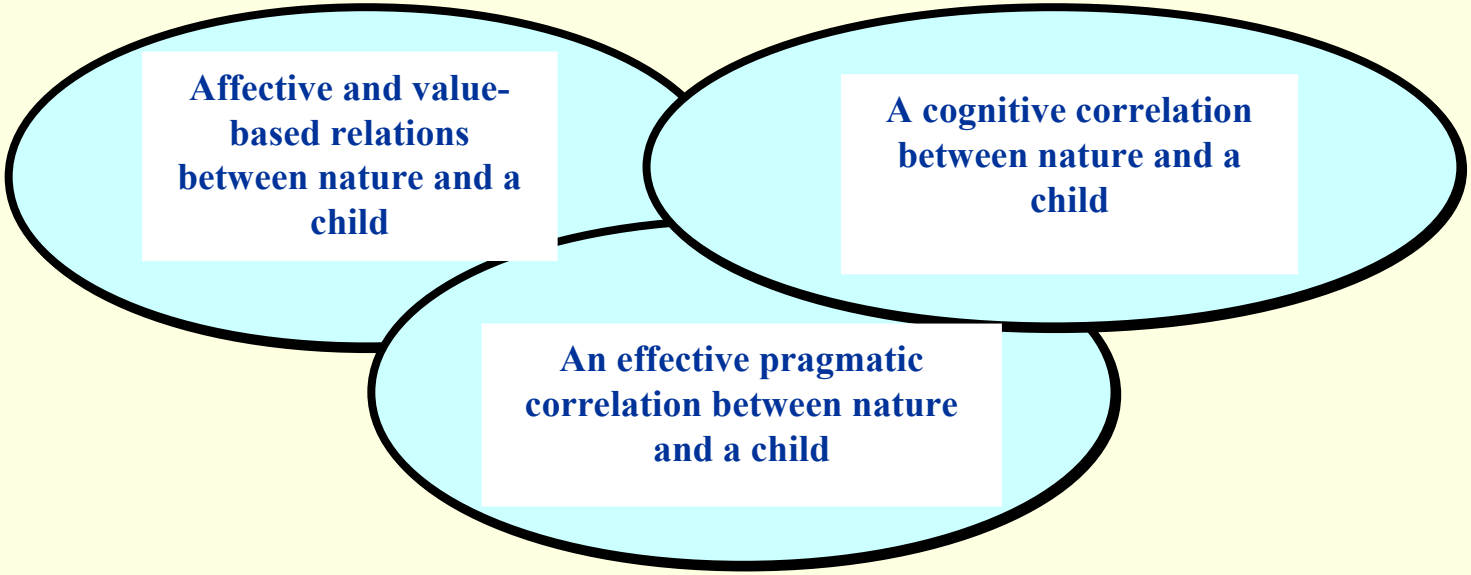
Synthesis, integration, classification, holism

TWO COMPETING PARADIGMS

Integrated curriculum paradigm ↔ Disciplinary curriculum paradigm

The younger the child the less s/he knows and manages, and therefore in terms of him/her, the degree of the integration of subjects has to be limited

INTEGRATED SCIENCE EDUCATION SHOULD REFLECT THREE CRUCIAL COMPONENTS BETWEEN NATURE AND A CHILD



Integrated natural science education → *General (holistic) world picture*

A primary purpose of integrated science education is:

the construction of the whole world picture, the development of the child's world outlook and intense correlation with an environment, the fosterage of affective experience

PRACTICAL TASK

- **The story based on individual experience and told by a teacher S.Bučiuvienė (LT)**

1. Independent reading of text.
2. Discussion in groups.
3. Presentation of groups ideas.

Important questions:

1.Does the elements of the integrated science teaching/learning are obvious in this situation?

2.Can you explain this situation from constructivist teaching/learning point of view?

Integrated science education creates theoretic and practic conditions because:

- an integrated environment (*content, process, forms, activities, etc*.) helps pupils to properly aware that human being and nature is a concern for a number of scientists of different areas and that the concepts of the unity between nature and human being, the majesty of nature, the limitation of universal perception are further formulated;
- the combination of science integration with the knowledge (in a broad sense) of other areas (humanities, social, arts, etc.) creates conditions for pupils' socialization, makes their intrinsic world ecologic (*the issue of the ecologic worldview and ecologic consciousness formation*), inspires warm feelings of love, duty, respect and responsibility for nature (ecologic imperative);
- the forms of integrated science education (*classes, excursions, conferences, etc*.) produce the media for expressing scientific, creative, spiritual, aesthetic components. Every learner runs an opportunity to obtain interesting and useful information, to express creativity and initiative, to more precisely acknowledge the world.

THREE DIMENSIONS IN INTEGRATED SCIENCE TEACHING

- Teacher centered – student centered;
- Teaching facts – teaching processes;
- Discipline oriented – daily-life oriented

THREE DIRECTIONS OF ISE

- ***constructive integration***; the knowledge of different subjects is invoked to solve a pressing problem or to run a course;
- ***thematic integration***; the content of an individual teaching subject is combined with the content of the integrating curricula;
- ***concept integration*** is inseparable from the discussions about the subjects of a general culture, from the usage of the concepts of the trends and genres of art.

KEY ELEMENTS OF INTEGRATED SCIENCE EDUCATION

1. Integrated programs (for example, general programs).
2. Integrated curriculum.
3. Integrated teaching /learning process.
4. Integrated teaching /learning methods.
5. Integrated teaching /learning activities.
6. Integrated teaching /learning content.
7. Integrated teaching /learning schedule.
8. Integrated evaluation of teaching /learning process.

PRACTICAL TASK

The situation about teachers` knowledge

1. Independent reading of text.
2. Discussion in groups.
3. Presentation of groups ideas.

MAIN POINTS ABOUT ISE

- The integrated curriculum must strengthen and reinforce existing student knowledge in a given area (Gunston, 1985; Jacobs, 1989);
- The integrated curriculum must extend student understanding into new areas, student need to participate in activities which allow them to grow and to learn (Underhill, 1994; Abraham, 1989; Francis, 2001; Šapokienė, 2001);
- The curriculum must make the connection to the real world. It directly influences the child's motivation to learn. (Fogerty, 1991; Makarskaitė, 2002; Lamanauskas, 2001);
- Thinking in terms of integration is generally difficult for teachers (Lang, 2001, p.132), at the same time they don't fully understand the process of integration and this limits their opportunities in realizing the integrative way of teaching in schools (Lamanauskas, 2001; Korozhneva, Melnik, 2003).

PRACTICAL TASK

- 1. To identify major points of integrated science education.
- 2. To identify the reasons preventing from the efficient development of science education.

P.S. Group work,
Brainstorming
Discussion (summary, main ideas)

INTEGRAL METHODOLOGY OF SCIENCE TEACHING AND LEARNING

- How to design of modern curriculum of science subject?
- How to use modern methods of teaching?
- How to teach students modern strategies for problems solving?
- How to evaluate correctly student`s knowledge and abilities?
- How to do science experiments in teaching with the educational effectiveness?
- What are the modern effective ways for using ICT in science education?
- How to use the systemic /constructivist approach in teaching?
- How to organize correctly classes and extra class activities in science?
- What is the integral methodology of science education?

IT IS IMPORTANT

- „Trying to avoid the fragmentariness of nature study, the educational process must classify the knowledge of sciences and their content, to look for, find and show the correlation between separate facts and phenomena of natural science inside every single educational subject when discussing individual topics, connecting them with the content of all subjects of science and integrating all related knowledge into the system. „The attachment“ of learners‘ consciousness to separate natural objects and phenomena can be evaded as it prevents from the embodiment of the schoolchildren‘s world outlook“ (**Vaitkevičius**, 1996; p.109).

QUESTIONS, PLEASE

If NOT, I must go...Thanks for your attention