Application of Lindsay, Rumelhart, and Norman's Model in Man and Nature School Subject with Children with Special Needs

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Introduction

A man and nature school subject is part of the *nature and ecology* culture-educational area. It prepares the students for learning in the next levels of high school education – school subjects *Biology and health education*, *physics and astronomy* and *Chemistry and environmental protection*. There are two aspects of this preparation. First is acquirement of terminology and specific knowledge in the respective areas as well as mastering methods for researching and studying the nature and environment [6]. Second, formation of students' interests and positive attitude towards the nature and the science those study it. The school subject has integral character. That has determined by the fact that school contents combines information and study methods from different areas of the natural sciences. They are mutually connected and integrated. They all follow the aim: building a whole, united picture of the nature and the role and position of man into it [7].

In the state educational requirements, there is detailed explanation of goals and tasks on this school subject *Man and nature*. The problem is that there is no separation of the sections. It would be very difficult for the students with mental retardation to use. In the state educational requirements there is no distinction between students with (students with mental retardation, hearing loss, vision loss, etc.) and without special needs. Thus, students with special needs have needed of individual plan by a resource teacher. Unlike students with special needs, students without special needs are in the age group 10-14 years old (these are the years when school subject *Man and nature* has taught at school). This is the period when forming of different interests begins in the youngsters [2]. Simultaneously, memory capacity grows and thinking process goes deeper than before, the abstract thinking is developing also in that period.

All noticed problems in the teaching process are related mainly to the abstract nature of the teaching contents and the syllabus. This is the situation for students without special needs. For those with mental retardation the situation is much more complicated. A bigger part of the physical objects – such as: atom, atomic nucleus, electron, proton, neutron, stars, galaxies, nebulas, etc. – which are studied at fifth and sixth class cannot be observed directly not only in the nature but even when special equipment and laboratory conditions are provided. The overcoming of those obstacles is possible only in case that accessible and interesting performance of the teaching contents including many visual stimulus – schemes, diagrams, pictures, photographs and primarily models of objects and processes – computer programs that visualize different processes. All that is connected with development of students' abstract thinking and finding ways to extract information from that visual stimulus.

The students have to be acquainted with such objects as macro world, micro world and mega world – atom, atomic nucleus, elementary particles, planets, stars, galaxies, and nebulas in the period of teaching *Man and nature* at school [8]. The specific nature of the

teaching contents supposes development of abstract thinking in the learners as well as enriching their scientific knowledge.

The students to certain level have acquired the main subordinations (formula for mass number, gravity law) and basic terms (part of them mentioned above) so they can be able to understand them. Memorizing the text from the textbook, it should not be equal to the understanding it [9].

Regardless of the level of students' with mental retardation cognitive abilities aged, 10-14 it is possible different models to be used in the *Man and nature* teaching process. There is a programme developed by the author that has based on the Lindsay, Rumelhart and Norman model. This model has ruled by two main principles:

1. Development of the teaching has to be in a way that would allow application in different learning models;

2. Practical activities are influenced by skills elaboration but they not obligatorily influence the initially knowledge mastering.

Lindsay, Rumelhart and Norman's Model

The Lindsay, Rumelhart and Norman's model is the most interesting of all semantic memory models [4]. It distinguishes from all others by its flexibility.

According to Lindsey and Norman (Norman et al, 1975), when human's memory model is constructing there are many facts – detected by observations and scientific researches and experience – that unmistakably point two of its parts that are both equally necessary for its normal functioning. The first one is information base where "terms" are kept as well as knowledge for events together with the whole net of complex interrelation among them [4].

The second part of the memory is the data interpretation which is an active memory system that is relied upon for assessment of the forthcoming events, where and how new data should be remembered [5].

Remembering of Terms According to Lindsay, Rumelhart and Norman's Model

The terms are the most important information kept in the memory. Without the terms, an adequate mental activity is impossible. A person knows thousands of words most of them are word etiquettes of terms and in someone's memory, a number of terms without such etiquettes have kept [1]. However, due to the terms inclusion in a net of complex interrelations, they can be expressed even when they do not possess their own denominations.

The analysis of the semantic structures has made in some of the following ways:

- Terms definitions from dictionaries (terminological, encyclopedical, interpreting);
- Spontaneous definitions of the meaning in people's daily language activity.

The analysis results show that there is predomination of the following connections [1]:

1. Connection for classification into a category that means that the defined term belongs to it. This is the so-called generic connection in logics and linguistics;

2. Connections that lead to the characteristic, which disconnects the particular term from all other terms in its category (attributive connections) [1];

3. Connections with purpose towards examples – concrete representatives of the defined term.

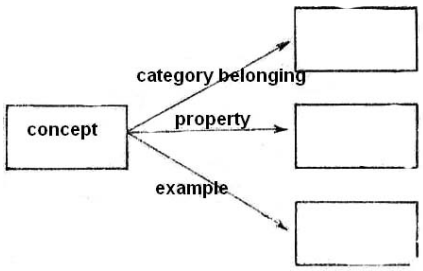

Fig. 1 *Scheme of term knots and the three types of connections among them according to RLN model. Schema of the standard presentation of one term [1]*

There is a scheme of the standard presentation of one term in figure 1 in the information base of the semantic memory according to the Lindsay, Rumelhart and Norman model.

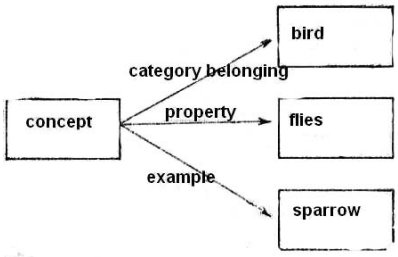

Fig. 2 *Scheme of term knots and the three connection types among them according to RLN model. A concrete example [1]*

If we fill in this scheme with concrete examples (Fig. 2) we will achieve a precise term structure. Since each of the terms is in connection with others, which have also connected with new ones, etc. Thus, the result is a huge net of complex interconnections among hundreds and thousands of terms that are in the information base of long-term memory [1].

According to Rumelhart, Lindsay and Norman's model a definition exists in the memory information base for a certain term that includes only its immanent characteristics – primary terms (e.g. the concept *velocity*). Moreover, in the concrete situation the term needs additional definition that contains some more concrete or situation features – secondary term (e.g. the terms "momentary velocity", "average velocity" etc.) [2].

For example, the concept *velocity* refers to the class *physical quantity*. The connections of this concept distinguish it from other concepts by the properties *direction* and *magnitude*. And the connection linking it to an example is 30km/h (Fig. 3).

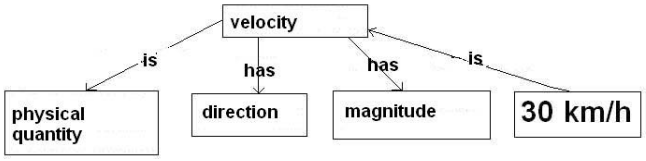

Fig. 3 *The term velocity according to the RLN model*

Description of the Platform

The program, which has proved its unique interactive, multimedia web or Stand Alone based products, has developed by means of Adobe flash. Essentially flash is a remarkably successful symbiosis between a vector graphics program and a programming environment.

The latest version of Adobe Flash – CS5 offers a variety of innovations in the construction of multimedia applications. Amongst them, the opportunities for three-dimensionality, rotational and perspective transformations, as well as the skeletal animation are of the greatest interest. Of course, this is a pseudo 3D, based on static perspective. Much better results are achieved through the incorporation of additional sets of classes, for example the free Papervision 3D and Away 3D

The potential of the MDM Zinc software has used for the final design of the product, which extends Flash's functionality in creating Desktop applications. This has achieved by a secondary compilation and installation of additional classes, many of which may correspond directly with the customer's operating system. Zinc simply turns the swf files, created by Flash into separate applications that do not need additional software installation – in this case, it is Flash Player. The only thing to do for operating with the product is to start it. Another new remarkable possibility of Zink is to compile executable files for Linux and MacOS, and such platform independence is an indisputable advantage for every application.

Directions for Achieving Teaching Goals via the RLN Model

The process of summarizing the Man and nature knowledge during school teaching (from 3 to 6 grades) in students without SN can be systemized in two directions. The first one has related to the hierarchic structure that is equally important to both Universe and substance structure. Using students' knowledge, we gradually systemize their understandings for the structure of nucleus, atom, and molecules (Fig. 4, Fig. 5, and Fig. 6).

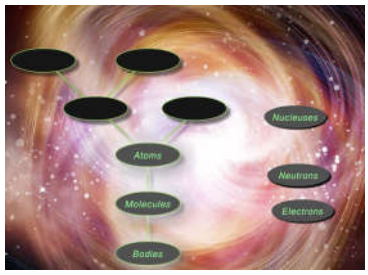

Fig. 4 *Computerized logical scheme № 1*

Fig. 5 *Computerized logical scheme № 2*

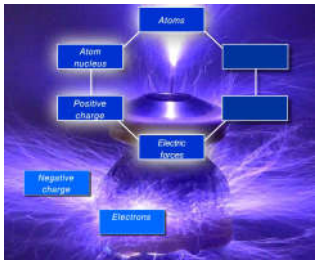

Fig. 6 *Computerized logical scheme № 3*

It is expedient to focus the students' attention on the fact that all matters exist in three states: liquid, gas (plasma) and solid. We can remind of the structure of Universe via talk and discussion. During the discussion, we can build the hierarchic structure of matters as well as of the Universe. Making clear to the students all kinds of forces that are functioning among the constituent particles and the bodies in nature, the main idea is easier understandable for them: world's unity and diversity. The student should be convinced that knowledge evolution gradually leads to understanding and revealing the secrets of micro space as well as vice versa – understanding the structure of mega space. The world is one and this unity has manifested in all objects and phenomena. The second direction has related to the energy sources. We systemize the students' knowledge for the different energy sources based on the global issues and problems that the civilization face when using them.

Description of the Application

When designing the computer programme it has taken into consideration that there is a hierarchic structure among the concepts, according to the Rumelhart, Lindsay and

Norman's model. The hierarchic tree has composed of using Rumelhart, Lindsay and Norman's theoretical model towards selected concepts. That tree has used for base when designing the computer programme. The programme has based on the idea of logical puzzle. Thus, by playing important terms and concepts students with mental retardation have acquired in a *Man and nature* while all of the concepts have arranged in well-organized hierarchic structure. The student sees a logical scheme on the screen that must fill it in (Fig. 4). The students - following the logical way and using the knowledge – must add all omitted elements. When a student place a concept incorrectly on an empty spot in the hierarchical tree, the programme immediately assesses of the filled in information. The programme rejects the concept from that wrong spot when a mistake has made. When the concept has filled correctly, the programme accepts it. This game continues until all elements have placed precisely.

Conclusion

The dynamic development of computer technologies in the last decades has stimulated to use energetic development of educational computer programmes in schools where students are hungry for new and different teaching models, especially when learning such difficult subject as a *Man and nature*.

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9. Учебна програма по човекът и природата за VI клас.