ACTA DIDACTICA NAPOCENSIA
Volume 2, Number 2, 2009

TEACHING SCIENCE: NEW TRENDS IN PRE-UNIVERSITARY LEARNING

Adrienne Kozan-Naumescu, Roxana-Diana Paşca

Abstract: A series of aspects regarding the aria of teaching sciences (chemistry, biology, physics, geography) in pre-universitary learning is presented. This paper underlines the importance of pre-representations of students in teaching-learning process in pre-universitary learning, assuring in this way a desirable direction of the reform in pre-universitary learning: so that the student becomes its own self-improvement agent. The characteristics of the reform in pre-universitary learning in our country are revealed, in European context (Naumescu, A., Paşca R. D., 2008)

Zusammenfassung: Es werden einige Aspekte aus dem Bereich des Wissenschaftunterrichts in dem Schulwesen analysiert (Chemie, Biologie, Physik, Geographie). Die Arbeit unterstreicht die Rolle der Voranschauung der Schüler im Ablauf des Vortragens und des Lernens. In dieser Art wird ein Ziehl der Reform des Unterrichtwesens gesichert und nähmlich der Schüler soll sein eigeners Vervollkommunngsagent werden. Die Eigenschaften der Reform des Unterrichtwesens in unser Land werden, in Europaischen Rahmen, unterstrichen.

Key words: reform in pre-universitary learning, pre-representations, competencies

1. Introduction

Reforms in education are determined by the request of the socio-economical development reported to existing possibilities, referring to the economical conditions as well as the development of science, educational policy and managerial capacities in learning.

The explanation is simple: any kind of development implies people who are prepared to realize it (professionals of all categories), and school is the one to prepare them for this aim.

In traditional school, information stood on the first place, all attention was directed towards it, being the very important center of teaching process. In this concept information stood at the basis of science teaching and it was thought that the person who had the information could automatically operate with it at a satisfactory level (Boco M, 2002).

This concept has sometimes generated high performances, but at the students' mass level it has generated failure, which forced the opened learning systems to resort to important reforms. All over the world, the postindustrial era needed huge masses of people with a preparation that allowed them to use the sophisticated instruments of the new millennium, given the poor economical conditions of the present moment (Naumescu, A., 2006).

2. Present trends in teaching sciences:

The expansion of the EU has determined a flexible interpretation of Europe, which allows us to include different societies from the European area into one sole conceptual unit. We have to mention that, given the cultural diversity, it would be a mistake to consider that European integration only represents a group of entities, without common criteria (Marga A., 2003). In the United States of America and in Europe many reform projects have appeared, for example **CHEM Study**, **B.S.C.S.**

Received 28 February 2009, accepted 7 June 2009, published 24 June 2009

(*Biological Science Curriculum Study*) or **C.B.A.** (*Chemical Board Approach*). These programs share the same objective: replacing '*memorizing*' with '*understanding*' and *interpretation* of phenomena and processes from the domain.

Numerous associations from Europe: **E.S.E.R.A.** *(European Science Education Research Association,* http://www.physik.unidortmund.de/didaktik/esera/*)*, **R.O.S.E.** *(The Relevance Of Science Education,* http://www.folk.uio.no/sveinsj/*)* share as their major objective, conciliating the diverse problems in education, problems which are connected to the social context and the socio-economical and political conditions in the country. Reforming the educational system appears as an objective necessity, responsibility of teachers from the pre- universitary and universitary learning systems.

We consider that the reform in pre-universitary learning shall not be imposed downwards at a theoretical level but *realized upwards* by the teachers. Nowadays teachers have the duty to reform the educational system .In some countries from the EU (Belgium, France, Austria) the educational reform is being realized upwards: the curriculum with the specialized contents of school programs, with the objectives, the means of learning, forms of evaluation, are being suggested and elaborated by teachers from the pre universitary and universitary learning, inside the Continuous Forming Centers in those countries, based on school reality realizations, successes but also on school failure (which exists due to various reasons). Among the measures imposed regarding the educational reform, at the present moment, one step away from the large family of European countries, we begin with the analysis of the socio-economical conditions in our country, related to the countries from the EU.

To resume, these measures regard the following aspects:

-Curricular reform in primary schools, high schools and universities: reform of the curriculum and the syllabus, new alternative manuals based on determined objectives/special abilities, restructuring the school year, **evaluation reform in the teaching-learning process** in every school subject, elaborating an institutional evaluation system, promoting certain professional standards, extending vocational schools, applying the transferable credits' system.

-Reorganizing the teaching-learning process, so that the subject becomes its self-improvement agent, capable to solve problem situations. This direction implies simplification of school learning plans so that inside different teaching sessions, students' pre-representations should be appealed (Naumescu, A., Pirson, P., 1993). Criteria for teachers' evaluation according to international standards should be introduced in universities.

-Continuous education of teachers in pre-universitary schools is one fundamental objective in learning. This ensures deep knowledge of the thought subject and psychology as well, development of special capacities and abilities all for the adjustment of the teacher to the changes in learning. Teachers are being preoccupied by their continuous improvement in two directions: raising the level of scientific knowledge of the specialty (for example: *Chemistry as a science*) as well as raising the level of psycho-educational and methodical preparation required by the teaching activity in class, at the level of present requirements.

Regarding the reform in the Romanian learning system, a *National Curriculum* has been developed based on the plan that contains the objectives and the contents of teaching. The pedagogical term 'curriculum' is being understood as a system which contains and combines the objectives of education and instruction, the content of the learning process, and methods for teaching, learning and evaluating (Postelnicu, C., 2002**)**.

Through the restructuring of school programs and the introduction of alternative school books an attempt was made in order to direct attention from simply memorizing irrelevant information, towards formative activities. Inside the curricular theory and practice, analytical judgment of students was emphasized, as well as stimulation of argumentative abilities and conversational capacities (Pintilie, M., 2003).

The Romanian educational reform has to reach certain goals: (Naumescu, A., 1997):

- To be conceived in a comprehensive, global vision
- To really and authentically take place

- To be an ample scientific reform based on expertise
- A real reform has to take place and it should not represent a political compromise but a real and deep change in the system with a strong scientific fundamental basis
- To use new ways of public and democratic debate and constantly implement pertinent decisions for the construction of a new educational concept
- To ensure transition from an industrial society to a knowledge based society which shall ensure knowledge and globalization of economical performances
- To offer the basis for constructing an educational society, taking into account that the evolution of learning and education cannot be separated from general evolution of the society an the values accepted, promoted and anticipated by it in a certain historical era.

The main direction in which the educational reform has to take place is the following (Dragomir, M., Chicinaş, L., Pleşa, A., 2004):

- Authentic decrease of informational overloading by selecting, modeling, transforming and structuring real relevant information.
- Decrease of the percentage of memorizing data and putting an emphasis on using the information, giving it a new meaning and usage and passage from reproductive learning towards creative learning, ensuring functional and methodological coherence and relevance of the curriculum, through the development of an educational concept adapted to the studied discipline.

3. The purpose of the pre-representations of students in the study of science

It is well known that most of the scientific knowledge gained during school years is forgotten after a period of time. For school it is very useful to answer a series of questions as: **What kind of knowledge is transmitted**?(the purpose of knowledge), **How is this knowledge being transmitted?**(methods of learning).

G. De Vecchi and A. Giordan (1987) have observed that students have **pre-concepts** and they have proved that those pre-concepts form the very basis of the learning process in science. Numerous studies regarding the pre-representation of students also appear in the specialized literature of the last decades.

The meaning of the term '**conception**' emphasizes the idea of one main element of **knowledge building**, and the term '**representation**' refers to an assembly of ideas and images used by students to solve problem situations. So, students own **pre-concepts** and their gradual evolution shall represent the basis of knowledge in science, and more precisely in chemistry.

The necessity of developing teaching models based on students' pre-representations appears.

A few possible attitudes could be the following (A. Giordan, De Vecchi, G., 1987):

a) - we ignore them as we consider them to be parasites

- we avoid them, which means **DO WITHOUT**

b) - we consider them teaching instruments

- we only use them as motivation

- we allow them to appear, which means **DO WITH**

c) – we confront them in order to confirm or infirm them and transform them , which means **DO WITH, TO GO AGAINST**

We continue with the analysis of **an experiment based on the value given to the**

pre-representations of students (A. Naumescu, P. Pirson, 1993):

The experiment took place in Belgium in 1993 and had as an objective the study of the role of pre-representations of the subjects (60 students aged 12-13 years), regarding a few elementary words: **ELEMENT, REACTION, DISSOLUTION, PRODUCT, FORM**. The subjects had not yet begun the study of chemistry in school, but had had biology and physics lessons. Chemistry uses a scientific vocabulary, new notions typical for this discipline, but also a series of common terms, which in this context gain new meanings. The authors had considered the student not to be an **empty bag** that every teacher **has to fill with** new knowledge, but a living element, owning **pre-representations** acquired outside school (mass media, family, society). These **pre-representations** can be more or less accurate. The role of the teacher is **to discover** and **confront** them in order to confirm or contradict them so that the teacher can reach **the building of new knowledge** in class, with the subjects.

In order **to discover** the pre-representations of the students the authors have used:

Graphical tests.

Individual interview.

Observations based on dialog between students.

The subjects have solved the test inside the school environment as well as outside the school. Regarding the five words mentioned earlier, each student gave an answer (the answers are written in italics):

Faze I: (written) - draw everything that the word suggests, build **a system approach** referring the notion.

Faze II: (oral) – explain to the teacher or another student whatever he wanted to show in the drawing.

Faze III: (frontal) – grouping the most frequent pre-representations.

An example referring to tests and interviews regarding the word '**DISSOLUTION**' (A student's answer given in the experiment):

Faze I:

1. Draw whatever the word '**DISSOLUTION**' suggests to you (5 minutes)

a) Draw whatever this word suggests to you

Figure I.1. *A student's answer:*

2. Answer the question: **What does dissolution mean?**

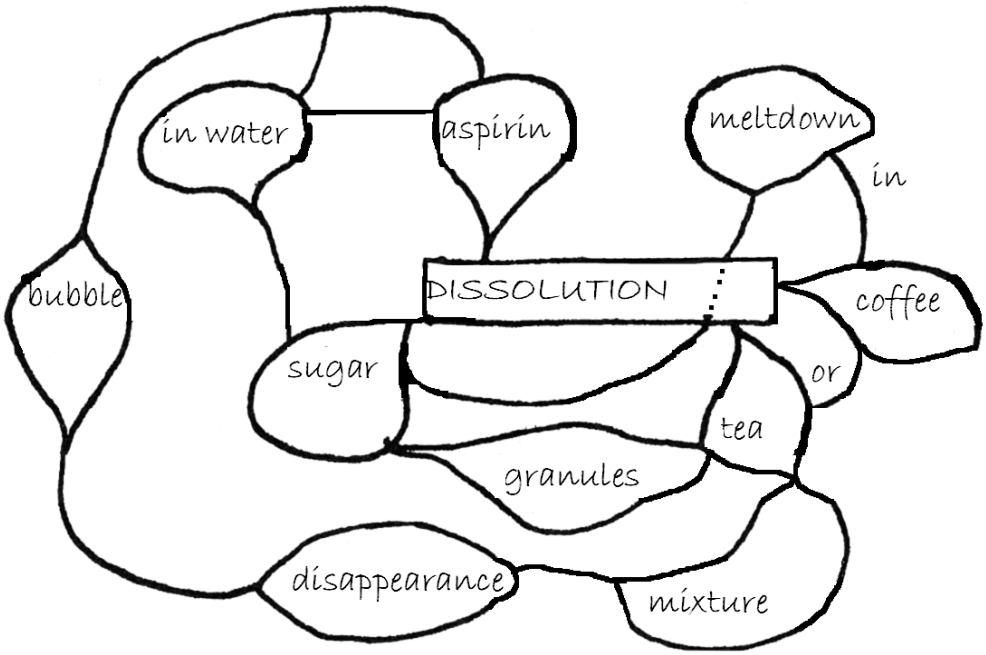

Figure I.2. *One answer to the question: What does dissolution mean?*

3. Fill in the blanks:

I talk about dissolution everywhere because I want to express a …….. (3 words maximum)

Faze II (oral, took place after a few days):

1. Student **A** explains to the teacher what it was that he tried to show in his drawing and the teacher writes down the explanation (figures I.1 and I.2).

2. In the presence of the teacher who writes down the dialogue, student **A** explains to student **B** what he thinks **dissolution** means:

'I drew a glass and an aspirin tube. One pill fell into the water and made bubbles. The pill is gone away, it can no longer be seen.'

Global results of tests and interviews:

The general idea of dissolution was that of one solid element introduced into a liquid (most of the times, water).The solid is no longer visible and children are convinced of **its disappearance**.

Main **pre-representations** regarding **dissolution:**

1. Disappearance

2. Melting

3. Mixing.

After **having discovered the pre-representations**, the teacher has confirmed or infirmed them throughout dialogue (heuristic conversation), experiment (the dissolution of sugar in water and the sweet taste that contradicts **its disappearance**).

The real meaning of ' dissolution' can be reached through conversation for example: each time an element called solvate (sugar for example) is not visible in a liquid called solvent (water) but can be found with its characteristics after the evaporation of the solvent, we can state that the solvate had been dissolved in the solvent (A. Naumescu, P. Pirson, 1993).

Similar activities took place regarding the rest of the notions: **ELEMENT, REACTION, PRODUCT, FORM.**

4. Conclusions

The teaching-learning system has to become nowadays a **learning** system based on a **simple** method, centered on the student.

Teaching methods have to determine the student to think, reflect, in order **to discover** new notions and concepts.

Present **school programs** underline the importance of students' accumulations at a formative level. Focusing on objectives/abilities is the only way in which the expression '**student centered**' shall not remain a meaningless statement (Ulrich, C., 2000).

Focusing the curriculum on **objectives/abilities** comes to meet the studies regarding the psychology of knowledge, which states that the transfer and mobilization of knowledge and capacity in new and dynamic situations, is being realized through ability.

This way of curricular projecting, based on capacity, simplifies the structure of the curriculum and ensures an increased efficiency of the teaching-learning and evaluation process.

In the attempt of establishing capacities, it was considered that the solution could be found at the crossroads between the teaching domain- regarding the curriculum and the socio-economical context- regarding the preparation for joining the workforce market, and the knowledge domain- represented in school by a study subject, psychologically described through a characteristically expert way of thinking in the cognitive meaning of the term. It all reduces to the manifestation of a cognitive behavior, which is characteristic to the domain, using and mobilizing similar abilities to those of a specialist, in contexts adapted to the age and level of information of the student. Therefore, six steps regarding the structuring of mental operations have been taken into consideration: perception, interiorizing, building mental structures, expressing, internal accommodation, external adapting.

The existence of programs based on students' accumulations has determined a certain direction of change in the teaching of every discipline. The difference between traditional teaching and modern teaching stands in the different conception and structure of study situations: rigorously directed in traditional teaching and having different degrees of autonomy in modern teaching. Otherwise put, a strategy is either legitimate or illegitimate not generally speaking, but according to practical circumstances. The effective teacher is someone who can select, combine and validate different methods, choosing proper strategies.

On the other hand, science is a component of our everyday life: to know means to be able to use what you have learnt (A. Naumescu, C. Corpodean, 2001**)**. Knowledge becomes part of continuous forming process that uses supple, dynamic, flexible and personalized methods of study.

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Authors

Adrienne Kozan Naumescu, Babeş-Bolyai University, Psychology and Educational Sciences Department, Cluj-Napoca, Romania, e-mail: kozanadrienne@yahoo.com

Roxana-Diana Paşca, Babeş-Bolyai University, Chemistry and Chemical Engineering Department, Cluj-Napoca, Romania, e-mail: rpasca@chem.ubbcluj.ro