

Conducting Chemistry Lessons in Georgian Schools with Computer-Educational Programs (Exemplificative one Concrete Program)

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Abstract: The article presents author's multi-media teaching course on school course chemistry (7,8,9 level), created in Ilia Chavchavadze State University with financial support of Rustaveli Fondation. Teaching materials are presented together with visual dynamic models of chemical processes. The changes and additional information can be introduced any time due to the structure of the course. Therefore, the model contains the elements of Case Study. Those principles of didactics are considered, realization of which are particularly efficient by educational computer programs on the lessons of chemistry. The question is about the stages of educational process, during which teacher can efficiently use such programs. In the article is overviewed the situation of teaching chemistry in Georgia nowadays- problems and the ways of solution of this problems. Is shown the ways to integration chemistry with other subjects, e.g. biology, history and arts.

Introduction

Chinese sage was asked: what can we do in order that people live better. He answered, that it depends on period of time. If it is only one year, sow rice for the subsistence of people. If it is twenty years, than plant fruit trees, than people can be delighted with fruits. If you mean hundred years, educate the people and every problem will be solved.

It is indisputable truth. There is nobody stronger than educated man. Although, unfortunately some subject have the "privilege" to be "fearful" for children. At the lessons of the "fearful" subjects children come with sense of duty and they take nothing from lessons. What is cause? They haven't motivation.

In this case I mean chemistry. Where are the roots of such attitude to chemistry? They must be searched in the process of teaching of chemistry, in the forms of its account and present to the children. This form must have one aim – to go to the lesson of chemistry must be a little holiday and not obligation, because a pupil doesn't afraid of this subject. To excite the curiosity of a pupil is very easy, especially to such "indocile", "capricious", "stimulant" science as chemistry. The points on the agenda are in what form present and discuss each chemical phenomenon.

So, how can we interest pupils on the lessons of chemistry? Which principle of didactics is better to create merry and gripping lesson? –We accentuate on obviousness, on scientific character and availability (certainly it is our opinion and it is possible that others accentuate on different approach.

The Study

The *obviousness* principle is very important for the lessons of chemistry and other natural sciences. It is very difficult to imagine chemistry without experiment, which unfortunately is very rarely carried out nowadays in Georgian schools; on account of the lack of laboratories, preparations or simply time (not enough hours and enormous material). Such experiments also exist, which need special rules of safety and teachers in justice try to avoid them. Different chemical mechanisms, which are very difficult to study for pupils, need special obviousness and not only simple static picture, which they can see in books or in educational posters.

Availability principle and *scientific* character are also very important. Teacher must try to interest, motivate pupils with the subject (in our case - chemistry). Teacher must be in permanent search to find interesting chemical

histories and join it with them. By means of interesting chemical events and curiosities he can scientifically discuss the theme. For example, pupils may not know that the “reason” of “Titanic” ’s going down was hydrogen bonds, because it had run into iceberg. The firmness of iceberg (ice) is caused by hydrogen bonds. The density of iceberg (ice) is less than of water and it can float on the surface of water. It will be interesting to discuss the nature of bonds, which “had ruined” legendary “Titanic”.

Or... Everybody had felt that after thunder-storm air is very fresh. Why? Yes, ozone forms in atmosphere, which is unstable and decomposes with the isolation of oxygen. What are ozone and oxygen to one another? And what is oxygen, which we breathe?

End now we want to discuss the problem of the form of presentation of different questions, about what we had spoken above. One of the most effective form (among other forms) of the presentation of material to pupils is the educational computer program, which gives possibility to realize above-mentioned all three principles.

The *obviousness* principle in such programs can be realized very efficiently, because it can be not only static and planar, but dynamic and practical, decorated with different effects, among them-sound effect. It can be hyper textual with complex labyrinths, from where we can pass to another logically connected obviousness.

The modeling of the experiments in such programs can be represented by different spectrum (among them for the experiments which need special rules of safety), if we carry them in real time in the process of lesson.

There are a lot of possibilities in this programs to realize the rest two principles.

Such computer-educational programs are also called “Author’s programs”, because they represent the view of given author or the group of authors, which are unique and never be repeated. In spite of this, it is inadmissible that such program was turned into the electron version of any textbook .

When creating educational courses, we must take into consideration, that they must not be transformed into electric version of textbooks (without any novelty). Such courses (they can be called “Author’s courses”) must reflect the view of the teacher (or the group of teachers) which created them, about the optimum teaching of the correspondent subject. The author’s courses are created on the basis of the knowledge, methodical and didactic finds of the teacher (or the group of teachers).

The main aim of creating electric programs is to establish the model of the process of teaching concrete course. In this case it is important not only the specific character of the subject, but the individual habitus of the creator of the course, it is also important the establishment of the general methodics with general methods and general instruments. Such methodic contain the description of the content of the course on the basis of semantic nets, which are connected in definite limits by variable succession from the simple to the complex. They can be founded fractal-layer by layer. This layers create the skeleton and on its basis the whole process is formed. The visualization will be static, dynamic and spatial. The teacher, on each stage of the teaching, can apply to the resources of the illustration which he needs (Vernin, & Chanon, 2000, p. 139-150).

It is known in psychology that a person perceives 90% of information of the surrounding environment, from vision 9% from hearing and 1% from touching (Woolfolk, 2000, p. 223).

Also “teenager gains latently more material, he/she uses in a specific reason, though there may not be the question of remembering of material” .

To remember something latently is depended upon the emotional mood to the material which would be remembered.

If a pupil is indifferent towards the subject he /she remembers it superficially.

Everything which causes emotional feeling leaves the deep track in the mind and is fixed firmly.

In this case it is very important to make students interested in studying material. Such interest may be risen by using computer learning programs and the lectures given according to it rise pupil’s remembering mechanism of reachiness and mood towards the learning material.

According to D. Uznadze conception mood is created in simultaneous figurative conditions of two factors, with the demand of a person in the suitable environment of the given figurative conditions. If one of these factors isn’t given the mood can’t be created. A person will get into mood with the fulfilment of the activity of the specific situation based only on to the suitable requests (D. Uznadze, 1940, p. 335).

Computer gives the opportunity to get vivid, eminent and convincing illustrations about those events, which are attached to chemical process.

The process is reflected in dynamics on the screen of the computer together with the selected colors and according to the multimedia.

The live word of the teacher is also attached to the process and so we can see two necessary factors for creating the mood, which causes student’s corresponding activity-readiness for gaining and studying the material firmly.

It must also be mentioned that “the mood gaining once, never loses and stays with the person, as the new readiness of actualization, in the new corresponding cases”.

The use of computer teaching programs contains the following stages of perception process:

The aim of the first stage is the forming of the student’s motivation towards the learning topic (material). At this time it is important to prove the necessity of the topic, to display its important features, juxtaposition of the other subjects (connection of different subjects). The whole class will be involved in this process and it would be right if the teacher used the most interesting illustrated computer materials of the topics which would be studied.

Though at this stage the suggested visual aids mustn’t contain the deep contents of the materials which would be studied as this point is the main task of the next stages.

The aim of the second stage is to discuss studying material consecutively and deeply. While teaching the new material it is necessary to use the illustrated materials.

In this case the advantage has good computer learning programs with the help of which it is possible to keep an eye on the development of the dynamic process of the studying material and in different scales. E.g. The development of different chemical mechanisms on the micro and macro levels of course the continuation of the reactions must be put into the computer models, the performing of which is difficult or impossible for many conditions in the laboratory circumstances.

On the third stage there is a process of perception of already explained material.

It is very important the scientific language of the given subject, the learning of main terms and concepts. It is also suitable (on this stage) to use the multimedia models which contain especially difficult theoretical concepts. Together with it there must be taken into consideration student’s interactive relation towards the studying material in the program maintenances.

Verbal methods are used on the *fourth and the fifth stages*. In this case also must be used computer illustrated material showed on the second stage. Which must be filled with findings of related subjects. The elements of this program must be discussed, debated in the lecture- room.

The last - the *sixth stage* is proposed for testing the studied theme. The teacher tests not only the general contents of the material, but the ability of the pupil to join this information with other sciences and to use it (the new information) for the solution of the new problems.

The content of educational material must coincide to the national educational plan, but it must be enriched by more information, by concrete examples and with corresponding commentary. Some of the topics will be taught by axiomatic method and information will be represented in the form of graph- the unity of concrete and declared teaching will be realized. Each topic will be connected with the knowledge of a pupil. The content will be in accordance with modern state of the sciences.

Findings

Our program is created in Adobe “Flash” casing and it gives additional advantages, in particular it can be used in network teaching.

For example, the opinion of some teachers and pupils are adduced about computer-educational program in chemistry for basic schools (the originals of forms are kept in working-room of our group).

The teachers:

“I want to ask you to create such programs for high classes”. Chemistry teacher of 16th public school Kh. Nozadze;

“You must continue your work!!! To show animated experiments is very useful, especially in such schools, which haven’t laboratories, but have computer.” Chemistry teacher of 165th public school N. Nadiradze;

“I had adopted your uncommon idea with great pleasure. I am delighted, I like it very much! I hope you will contact with me after innovations.” Chemistry teacher of 2th public school Kh. Bregadze;

“I greet this innovation, I shall always have desire to use it.” Chemistry teacher of 100th public school N. Msvenieradze;

The Pupils:

7th class

“For studying the classes of chemical compounds we use computer program. It is very interesting. Afterwards we ask teacher and he carried out the experiment between sulfuric acid and sugar. It was identical to

what we had seen in program. It is nice, if it will continue in such a way, we shall become chemists. Such lesson is very interesting and we want more lessons."

"The teacher had taken us to the informatics room. She had explained the properties of water and we had watched chemistry program. I like "You are vineyard", bubbles of soap. At home I had done it myself".

"Show it again. We had understood it. I had remembered how to construct and represent chemical formula. The Georgian dance between Fe and S is bright. I am interested what I had seen in computer."

"I had understood well and remembered mixtures, the methods of their division on components. We often can't carry out the experiments, therefore I want to study chemistry by this program."

8th class:

"I think such lessons must be held in every classes. It is one of the way to give knowledge to the child, which is not interested in chemistry. Even though the minimum from the whole information".

"In my opinion, the CD with such themes must be in every schools, to excite the curiosity of more pupils."

"I have learned very much about chemical elements, the Periodic Table, famous chemists. Especially interesting were video materials and clips. You see everything obviously and get pleasure. I like that the mater is written clearly and it is easy to understand. I think that the CD is perfect for all ages and professions".

"More material must be created in future, to interest pupils and pleasure them by studding chemistry".

I want to underline one circumstance. Different education foreign (free) computer programs in chemistry exist (many of them we had seen by internet or on CD), also internet-sources (for example, Wikipedia - the free encyclopedia), but in this sources above-mentioned didactic principles are realized very poorly. I can't find the full dynamic obviousness in them. In some of them it was represented, but very poorly. The aim of such program is less text and a lot of dynamic obviousness and different methodic- ways for the pupil's motivation. It is known fact that for teaching two main factors are obligatory: teaching pupils with refined methodic and motivation for the study of presented information.

I mean to introduce such heading as: "May you will be interested", "May be you try", "Now let us amuse our self". I mean to find a lot of chemical curious (to create animation about this curios). For example, when we begin to consider acids, oxides, salts and alkali, especially efficient for motivation is the clip about boiling of egg. If we pour out water on calcium oxide, such large amount of heat will be isolated, that an egg can be boiled. Later this clip can be used when considering exothermic reactions.

Or the clip about table salt, by which artificial snow can be obtained. Or the reaction between sugar sulfuric acid. These clips are really sensitive for pupils, in parallel, the studding of the main "heroes"- acids, salts, oxides, alkali becomes more interesting.

To make musical background to the created chemical clips. Musical backgrounds can differ from each other. For example, in already created program we have "Chemical theatre" were elements go out on Shtraus' march, make the acquaintance with pupils and present very interesting information about themselves. In other clips there is Georgian folklore and even though rock, why not! On the whole we shall get motivated pupil and it is our aim.

Presented program establishes connection with biology. For example, at the consideration of metals and non-metals, individual block is devoted to their role in man's organism.

It is discovery for pupils, that in stomach such strong acid, as hydrochloric acid is formed. How is it formed? Which is more important for organism iron or magnesium?

In the schools, where mentioned program is used, the teachers of biology have joked, that from the lessons of chemistry, the motivated pupils come to them.

Also, I must underline, that in our program chemistry is connected with history of chemistry. At the lessons teacher hase reviewed periods, when the famous scientists was discovered they openings. Some of the subjects are connected with arts. For example, before studding Structures of molecules the pupil introduce to "Cubism", where artists use geometrical figures- square, triangle, hexagon. Picasso is the famous representative of "Cubism". The pupils will meet such kind of geometrical figures, when they study structures of molecules.

Or, let us speak about *water*. What is water? According to the words of Saint-Exupéry "The basis of life", which has special chemical activity. For obvious consider its action with metals. It reacts very actively with lithium and sodium, potassium burns when touching with water. From what it consists? From hydrogen and oxygen. Both have wonderful chemical biography. Exept the nature water is a part of man's body (cellular and intercellular). It plays different vital roles and its amount depends on the man's age, on the content of fat. Dehydration sometimes may be mortal for man.

We have spoken about hydrogen and oxygen which are the parts of water. Hydrogen was discovered in 1766 in London by Cavendish. Oxygen was discovered in 1774 by Priestly and Sheele in towns Lids-Upsala. In the

block of history the situation in England and Switzerland and the situation in Georgia will be discussed- what was happening in Georgia at that time, which problems (among them-scientific) were to be solved.

This lyrical digression helps us to make motivation in pupils.

The interface of program is very easy to use. Pupil follows across “green push buttons”, to see magnified clip he depress “mouse” on clip, or an magnifying glass, which is disposed on clip.

Conclusions

Acquisition of verbal or textual materials is a complicated process and is carried out stage by stage forming an entire knowledge in a particular subject. Sometimes pupils have their own imaginary concepts about the subject, but they may be false.

We consider it useful to incorporate computer programs in the traditional teaching process to facilitate information acquisition and formation of the so called “inner visual memory” which is a good basis for further development.

This program is in stage of creation (it will be finished at the end of 2009). Therefore, the constructed part of it is successfully used at school.

In consequence there is motivated pupil, with developed critical and creative mentality.

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