

A METHOD OF COMPUTER-BASED CHEMISTRY INSTRUCTION ; CONSTRUCTION OF CONCEPT MAP

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A concept is an abstract idea or a mental symbol, typically associated with a corresponding representation in an language or symbology. Concepts are expected to be useful in dealing with reality.(1)

Kaptan (1998:3) explains the benefits of concepts as followings; 1-Concepts help us to define things and events from our environment. 2-They provide communications among people. 3-They provide to arrange or group of knowledges or informations.(2)

According the above definition of concept, especially chemical concepts are difficult to understand clearly by learners. One of the teaching way of chemical concepts is map which is more used in all over the world. One of the most interesting methods is a construction of concept map by using computer. Chemistry education based computer provides more facilities to learners and teachers. The construction of concept map on computer is an example of student-centered learning and cooperative work. It helps increasing of communications among students and teacher-student relationship. Students are interested and motivated with investigating new concepts and relations between concepts.

Concept map can be used as review before exams. During the review, students ask to identify relationships, compare and contrast topics and integrate information into larger conceptual maps.

If we look at the use of computer from history, Jonassen D.H who is American scientist says that three approaches are 1-Learning computer 2-Learning from computer 3- Learning with use of computer. In first approach, students began to learn some terms about computer, parts of computer structure and functions of these parts of computer. In second approach, computers were used to present lesson and concepts. This approach was not developed the student's skills. In third approach, computers were used for educating by some computer programs. Students work on computer by the use of computer programs. They draw tables, construct concept map, make graphics, schemes and so on.(3)

Computer is different from other educational tools. If we compare computer and others, an important function of computer is to use for production, education, administration, presentation and communication.(4)

Today, there are enough computer programs to benefit in education. Students can develop educational materials by the use of computer programs which are MS Powerpoint, Excel, Macromedia dreamweaver, Flash and so on. According to Beyerbach & Smith's research between seventeen students, they can prepare concept map easily by using special computer program that is developed by R. Kozma & J.V. Rockel.(5)

For example, laboratory CD is shown but student's lab abilities are not developed because of no experimental works in laboratory. The third approach is more used in chemistry education by constructing concept map on computer. The main problem in chemistry education that the chemical concepts are learned incorrectly by students. The reasons of mistakes in learning chemical concepts are to choose incorrect method in teaching and to learn concepts without teacher.

It is being necessary to become widespread use of computer in science. In 1999, Third International Mathematics and Science Study (TIMSS) was replicated at the eighth grade. According to the TIMSS report tell us: less than 10 percent of eighth grade students in general science countries and half this percentage in separate science countries reported frequent use of computers in science class. The trend data from 1995 to 1999 show a small but significant increase for integrated science and small decreases for each of the separate sciences.(6)

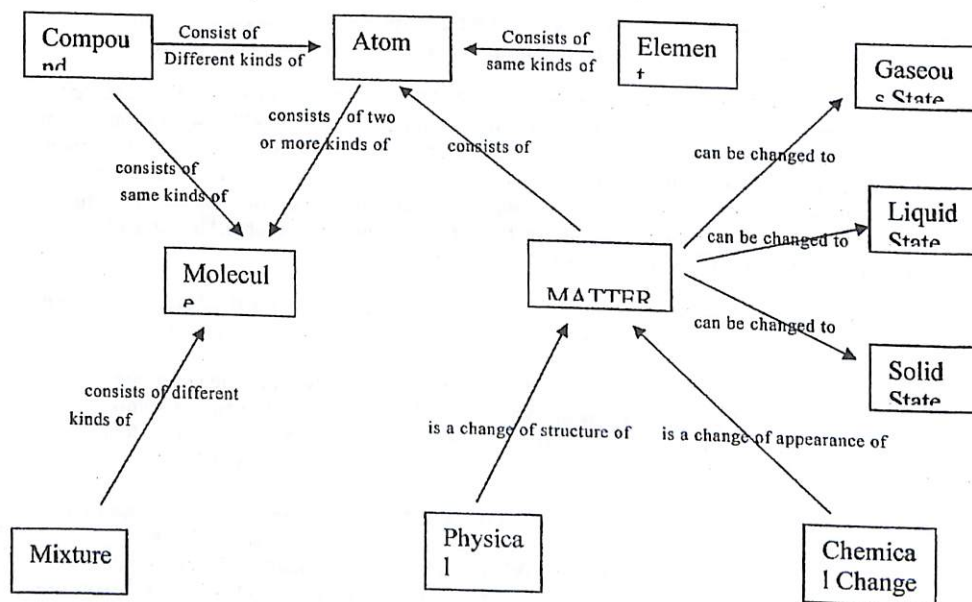
Concept map is a good choice for learning concepts, an important technique for active learning and useful educational tool for cooperative learning. Concept map is graphical tool for organizing and

representing knowledge. It includes concepts usually enclosed in circles or boxes of some type and relations between concepts indicated by a connecting line linking two concepts. (7) Educational tools which are tables, posters, schemes and diagrams can be used in chemistry education. It is not interesting and students do not understand correctly without educational tools in chemistry lessons. (8)

As you know, the nine-grade is the beginning class of secondary school in Turkish educational system. We think that if the main fundamental chemical concepts in nine-grade are known meaningfully by learners, it is a good beginning for chemistry education in secondary school. We should find main chemistry subjects which are taught by using concept map. The more subjects can be found in the construction of chemical concepts which are matter, element, atom, chemical bond and chemical reactions.

Concept map includes focal concept, key concepts and statements for concept's relations. The focal concept is main subject. Key concepts are subsubjects of main subject. Sentences are words which explain relations between key concepts. One of the important chemical subjects is matter. If the matter is given as examples of the construction of concept map, the focal concept is matter. The key concepts are liquid state, solid state, gaseous state, atom, molecule, element, compound, mixture, chemical change and physical change. These key concepts can be increased. Relations between key concepts are represented as sentences on concept map. The whole concept map of matter is shown as following;

Picture 1 : Concept map of matter



For above construction of concept maps, key concepts related to matter are enclosed in boxes or circles. The relations between key concepts are represented in lines. The direction of lines is very important. All relations are shown with meaningful sentences and prepositions. The more kinds of sentences for relations between key concepts can be written by changing the way of lines. This work is done with individual students or students in group. The finding key concepts, meaningful

sentences and illustrating the way of lines are active elements for construction of concept map. This concept map can be developed by students as homework and group works in class.

Some chemistry subjects of concept maps can be used to explain meaningfully them in addition to matter concept map. These concept maps are developed by finding key concepts and meaningful sentences which are related to focal concept and key concepts. Let's write the some focal concept, key concepts and sentences in secondary chemistry schools. These are ;

1-The first example about matter is presented in above picture.

2-The next example of concept map is about chemical bonds.

The focal concept: Chemical Bond

The key concepts are Intermolecular bond, Ionic bond, Covalent bond, Metallic bond, Hydrogen bond, Van der waals bond. Dipole dipole bond

In this construction of concept map, students try to find new key concepts which are examples of matter that can be bonded with above kinds of bonds. For example ; Water H_2O is the best example of hydrogen bond. Students try to find the best examples of matter that will be bonded with ionic, covalent, metallic, dipole-dipole and van der waals bonds. When they search suitable examples of matter and find relationship between these concepts, they learn correctly and meaningfully. This is the best example of active learning.

3-The next construction of concept map is about atom. The focal concept is atom. The key concepts are proton, neutron, electron, ion, anion, cation, ionic molecule, atomic number, mass number and nucleus. The sentences between concepts may be followings;

- anion is a negative ion
- cation is a positive ion
- electron is a negative particle
- proton is a positive particle
- neutron is a neutral particle
- proton number is equal to atomic number
- proton number plus neutron number is equal to mass number
- neutron number plus proton number is equal to mass number
- is a central part of atom.
- ion forms if electron is gained or lost from neutral atom
- anion forms if electron is gained from neutral atom
- cation forms if electron is lost from neutral atom
- proton is placed in nucleus
- neutron is placed in nucleus
- electron is placed around the nucleus
- ionic molecule forms if cation combines with anion
- ionic molecule forms if anion combines with cation
- electron number does not effect mass number

4-The next focal concept: Element

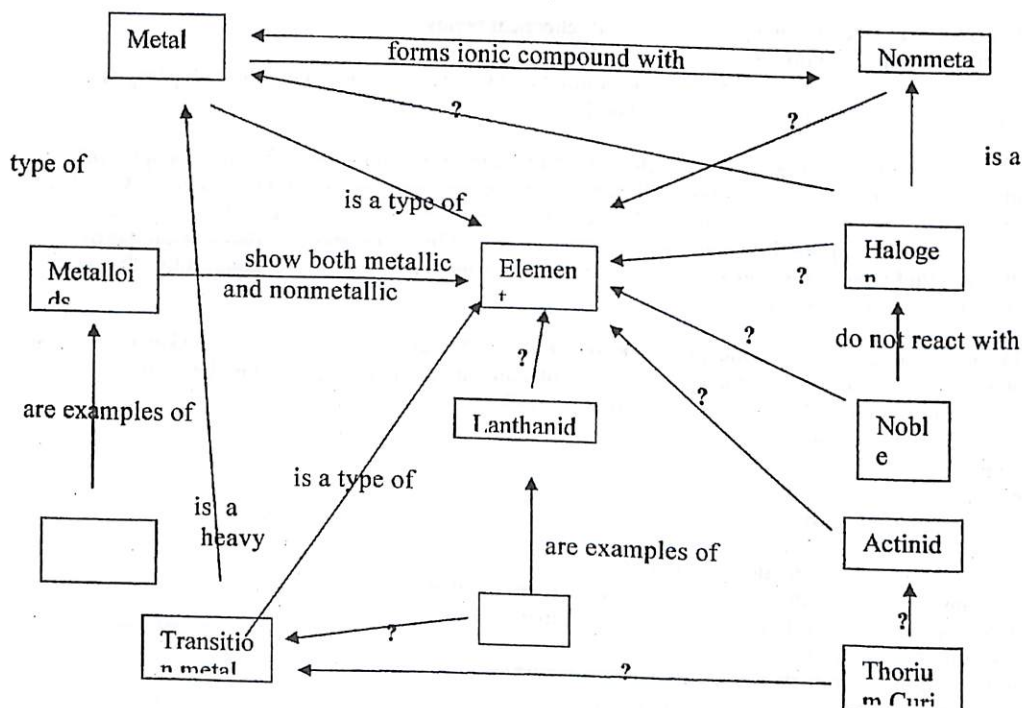
Key concepts: Metal, Nonmetal, Noble gas, Halogen. Transition metal, Lanthanides, Actinides and Metalloids. The meaningful sentences related to the focal concept and key concepts can be found by students or group students. This can be classwork and homework. As you know, when students find the

meaningful sentences between concepts, the ability of research, group study ability and communications with all group students are developed. Some sentences between concepts are; Metals are a form of element. Metalloid showing both metallic and nonmetallic properties is a form of element. Nonmetal forms ionic compound with metal. Halogen is a form of nonmetal. Transition metals are heavy metals. Noble gas is not nonmetal.

The above meaningful sentences can be developed by students with the help of their teachers. When they find the new sentences, they reach new knowledges about these concepts. They use additional sources and investigate meaningful knowledges. This is actually student-centered learning. They learn well and do not forget. In the following concept map, some key concepts and relation

sentences have not written. While students fill in the blanks and find the answers for question mark, they try to learn. This work is given as homework or groupwork by their own teacher.

Picture 2: Concept map of element



These meaningful sentences can be changed, increased and developed. When students increase or change the sentences, they learn to research and be active. So, it is not possible to forget sentences or knowledges. If they construct the concept map about atom and atomic particles, learn their subjects with using computer and develop knowledges about computer and computer use.

The education of chemical concepts with using computer is very fruitful for learning and teaching. Computer as a tool in learning concepts provides increasing ability of use computer, success of students and effective lessons on students. Concept map prepared on computer is useful for teacher while it can be used as educational tool or as a placard. Concept maps may be named as a small collection of knowledge about concept. So, when learners collect the knowledges, they gain ability of research, thinking and ability of creativity.

If we write activities in constructing concept map on computer, the following activities are effected to learn more.

- 1-Searching key concepts related focal concept
- 2-Finding meaningful sentences between the focal and key concept and among key concepts
- 3-Putting meaningful sentences between two concepts in suitable place
- 4-Using computer programs
- 5-Studying in group
- 6-Studying with teacher
- 7-Constructing and developing map

- 8-Studing in library 9-Searching from internet and using internet 10-Benefiting from new books
11-Producing new computer assisted science activities

We recommend that computer assisted science teaching activities like construction concept map should be on curriculum. Some studies show that to use computer assisted materials in science courses increase learning of science topics. It should be given detailed information how to use computer teaching materials and how to prepare the science activities and concept maps by computer programs. Area of knowledge is expanded with the area of internet and it is very easy to reach knowledge in this area. So, it should be taught how know ledges are organized no how it is used by use of computer programs. The prepared computer assisted educational materials should use to leach on lessons and it should developed these materials.

We conclude that concept maps are useful for teacher in presentation lessons and evaluation of students. They are useful to understand subjects of lessons easily and meaningfully by students. The learning chemical concepts from computer is active method in education.

Özet

Bu makalede bilgisayar yardımıyla kavram haritası oluşturulmasının eğitimdeki etkileri açıklanmıştır. Bununla ilgili iki kavram haritası, verilen kimya konusu ile ilgili ana ve anahtar kavramların bilgisayar yardımıyla harita üzerinde nasıl yer aldığı örnek olarak verilmiştir. Uygun kavram ve önergelerin bulunması ve kavram haritası oluşturulması öğrenme ve öğretme metodu olarak sunulmaya çalışılmıştır.

Түйін

Мақалада компьютер арқылы ұғымның байланыс сызбасын құрастыру қарастырылған. Ұғымның байланыс сызбасын дайындау және құрастыру кезінде химиялық ұғымдардың үйретудің тиімділігі көрсетілген. Сызбаны компьютер арқылы құрастыру және сызба дайындауды әдіс ретінде ұсынудың оқушыларға тиімділігі анықталған. Мысал ретінде 2 үлгі көрсетілген.

Резюме

В статье рассматривается понятие химической связей с помощью компьютера. Показана эффективность подготовки обучения о понятиях химических связей во время обучение при составлении подготовки схемы связи. Установлена эффективность для составления схемы с помощью компьютера и предложена подготовленная схема как метод. В качестве образца показаны 2 примера.

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