EMPOWERING HUMAN RESOURCES IN LEARNING CHEMISTRY BY USING MODULES

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EMPOWERING HUMAN RESOURCES WITH CONSTRUCTIVISM APPROACH IN LEARNING CHEMISTRY BY USING MODULES*

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ABSTRACT

The quality of education has always become important topics in public discussion. The Grade Point Averages (GPAs) of students seemed to be declined, especially in sciences. Chemistry is considered to be difficult to understand. It consists of abstract concepts. The students should be actively learned in order to understand the concepts. So that the students explore their human power by students active learning with constructivism approach.

Constructivisme is a learning philosophy which is rely on a belief that knowledge can only be obtained as the result of a construction process. People construct their own understanding, throught experiencing things and reflecting on those experiences. When we encounter something new, we have to reconcile it with our previous knowledge and the result can be in changing what we have believed, or maybe discarding the new information as irrelevant. Constructivist teachers encourage students to constantly assess how acivities helping them gain new understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally becoming "expert learners".

An example of research by Constructivisme Approach by using module was implemented twice. First, the research was conducted on the Chemistry taught by constructivism approach with module (treatment) and taught by conventional method at the outstanding and ordinary schools. Second, a Classroon Action Research in the State High School 10 Padang, at the tenth grade to disclose the students activities during learning process. Both of the research showed that the student activity and student s achievement are significantly improved.

Key word: student, activities, learning, knowledge and constructivisme.

A. INTRODUCTION

Constructivist learning has emerged as a prominent approach to teaching during this past decade. The work of Dewey, Montessori, Piaget, Bruner, and Vygotsky, among others provide historical precedents for constructivist learning theory. Constructivism represents a paradigm shift from education based on behaviorism to education based on cognitive theory. Fosnot (1996) has provided a summary of these theories and described constructivist teaching and learning practice. Behaviorist epistemology focuses on intelligence, domains of objectives, levels of knowledge, and reinforcement. Constructivist epistemology assumes that learners construct their own knowledge on the basis of interaction with their environment. Four epistemological assumptions are at the heart of what we refer to as "constructivist learning."

1. Knowledge is physically constructed by learners who are involved in active learning.
2. Knowledge is symbolically constructed by learners who are making their own representations of action;

3. Knowledge is socially constructed by learners who convey their meaning making to others;
4. Knowledge is theoretically constructed by learners who try to explain things they don't completely understand.

Within the constructivist paradigm, the accent is on the learner rather than the teacher. It is the learner who interacts with his or her environment and then gains an understanding of its features and characteristics. The learner constructs his own conceptualisations and finds his own solutions to problems, mastering autonomy and independence. According to constructivism, learning is the result of individual mental construction, whereby the learner learns by matching new information and establishing meaningful connections, rather than by internalising mere facts to be remembered later on. In constructivist thinking, learning is inescapably affected by the context and the beliefs and attitudes of the learner. Here, learners are given more latitude in becoming effective problem solvers, identifying and evaluating problems in order to transfer their learning to the problems.

If a student is able to perform in a problem solving situation, a meaningful learning should then occur because he has constructed an interpretation of how things work using pre-existing structures. This is the theory behind Constructivism. By creating a personal interpretation of external ideas and experiences, constructivism allows students ability to understand how ideas can relate to each other and pre-existing knowledge. According to Bruner, learning is a social process, whereby students construct new concepts based on previous knowledge. The student selects information, constructs hypotheses, and makes decisions, with the aim of integrating new experiences into his existing mental constructs. It is cognitive structures that provide meaning and organization to experiences and allow learners to transcend the boundaries of the information given. For him, the learners are independence, fostered through encouraging students to discover new principles of their own accord, lies at the heart of effective education.

Latest research in science education shows that conventional approach has changed to constructivism approach. Some research in learning chemistry by constructivism approach shows that the student achievement is improooved. Srini (2001) from Malang State University used learning circle approach to teach chemistry in high school, and she find out that the student achievement improved. Endang and Hayuni had used constructivism approach for Chemistry Instrument Analysis with using circle learning too. Dinur, Dasna and Fajaroh, also from Malang State University, all of them used Circle Learning approach and conducted the reseach in high school.

Researchers have conducted studies with Constructivism approach for learning chemistry by using module. By using colorful modules including pictures and schemata in the modules, the student motivation improved. The student knows how much they had learned by using the Answer Key after they work with Work-sheet. They can find out which concepts they had failed, so they can learn more to improve knowledge they have already constructed. By using this system, the students' motivation can improve after they recognize the errors they have already made and better understood the concepts they have to learn. The teacher can enhance the student motivation. By using questions that already available in the module, the student motivation can be improved after the student finish their work and answer all the questions. Feedback also improves the student willing to

learn and their confident after answering the questions and it is expected that their ability will also improved (Ellizar, 2008).

Constructivisme approach by using module also implemented in a Classroom Action Research in the State High School 10 Padang. The results of the observation on the student activities at the first cycle were: for six activities observed, four activities have been considered to be very satisfaction; one activity be considered as less satisfaction while one is satisfaction. On the other hand, for the second cycle, from five activities observed three has been considered to be very satisfaction while the other two activities were satisfaction.

Based on the two studies, it can be concluded that learning chemistry by using module was effective to improve students' understanding. The students were more active while they were working with module. Pictures and mapping concept in LKS can guide the student in finding the concept. Beside the student active in finding the concepts, it will increase the Retention. While the student working with work exercise, they can evaluate how much they had learn the concept. At this step, students can learn more if they still made a mistake on exercise. So they can achieve the standardized mastery in learning chemistry.

B. MODULE WITH CONSTRUCTIVISM APPROACH.

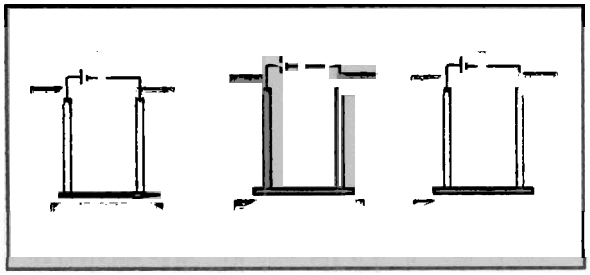
In order to create students' active learning in Chemistry the modules are designed with a contsructivism approach in form of scheme, picture and concept mapping. The students fill in blanks as they are doing LKS. In doing the LKS the students are guided to find out concepts through pictures and schemes presented in modules.

Example of module design :

ELECTROLYTE AND NON-ELECTROLYTE SOLUTIONS

SOLUTIONS OF ELECTROLYTES AND NON ELEKTROLYTES

Solution is a homogeneous mixture (*of **solution**: substance being dissolved and a **solvent**: substance being the solved*) between two substances or more, which do not clearly have its boundary area or part, as well as have the undistinguishable compositions at every its shares/parts. Solutes, in water, can be classified based on the electrical conductivity of the solution they form. Now, please pay attention to following Figure and fill the blanks with your comprehension of that Figure 1.



According to fig.1, metals *can /can-not* $_{(1)}$ Conduct the electricity. We can recognize from .....$_{(2)}$ bulb. We know that metals is a conductor But wood *can/ can-not*$_{(3)}$ conduct the electricity, and it can can be acquired by ..... $_{(4)}$ bulb.

Figure 1. Conductivity of the the electricity by metal and nonmetal

Based on their ability to conduct electricity, material in this nature are distinguished into **conductor** and **isolator.** Conductor is a material that allow an electric current to easily flow through its. Meanwhile, isolator is a material which is not allow electric current flow through it.

Like metal, solution can also conduct the electricity. A solution which can conducts electricity is called *electrolyte/nonelectrolyte solution* (5) and the dissolved substances (**solutes)** in the solution are called ***electrolyte substances.*** Meanwhile, solution which can not conduct electricity is called ***electrolyte/non-electrolyte solution*** (6) and the dissolved substances in the solution is called ***non-electrolyte substances.*** Look at Figure 2, then fill up the blank and answer some short questions with your comprehension of Figure 2. Sulfuric acid (H_2SO_4) and ammonium hydroxide (NH_4OH) is *electrolyte /non-electrolyte* (7) solution because it ..... (8) electricity, it can be seen from .....(9) light. In contrast, alcohol (C_2H_5OH) is *electrolyte/non-electrolyte* solution (10) because ...(11) electricity, it can be recognized from ....(12) light. Therefore, by conductivity, there are ..... (13) solution and ..... (14) solution. How can the solution conduct the electricity? What factors which mainly cause the conductivity differences in each solution? Which solution can conduct the electricity?
Please study this subsequent Figure 3 then fill the blanks!

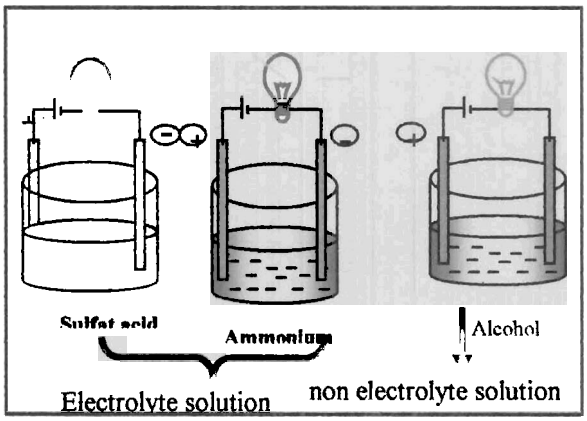


Figure 2: Electrolyte and non-electrolyte solution

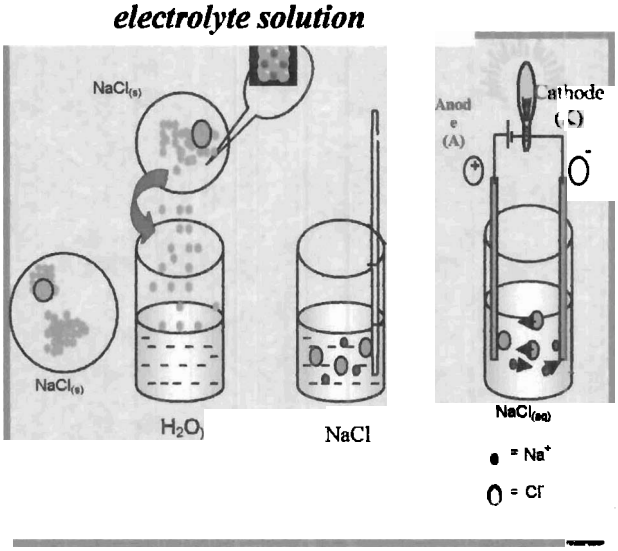


Figure 3: Dissociated Electrolytes Compound

According to Arhenius, electrolyte solution can conduct electricity. Look carefully on Fig 3. Salt (NaCl) will be associated into ions if NaCl (salt crystal) is dissolved in water.

$$NaCl_{(s)} + Aq \longrightarrow Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$

In this solution, there is an act of pulling to each other between $NaCl_{(S)}$ (salt crystal) and water molecule. Consequently, anions and cations are separated or estranged (this is so-called "**electrolytic dissociation**"). $Na^{(+)}$ (positive ion) as ***cation / anion*** (15) and Cl^{-} (negative ion) as ***cation / anion*** (16).

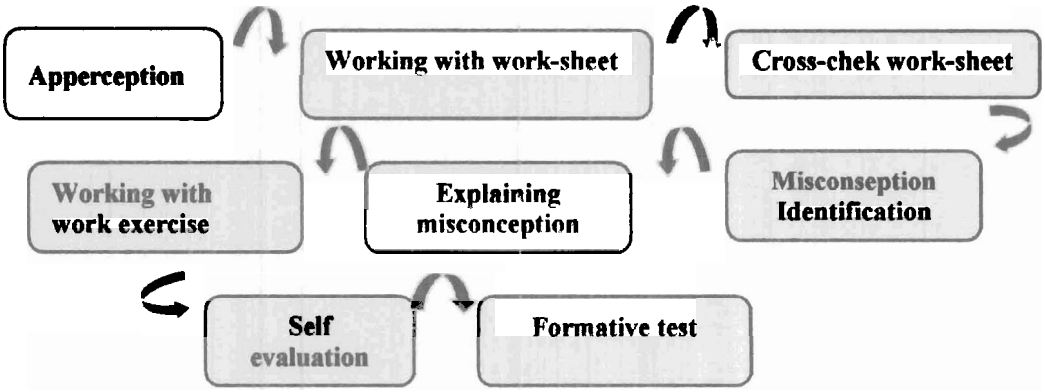
These two ions move freely in solution by which each of them is surrounded by water molecules (water molecules or chemical substance that contains water is so-called "***hydrate***"). If electrode is put into the water, $Na^{(+)}$ and Cl^{-} ions will move to the electrode at the same time stream the electric current to both strand of metal pole (electrode pole).

Negative (-) electrode pole is ..... (17), and positive (+) electrode pole is ..... (18). $Na^{(+)}$ ion will move to ..... (19) electrode, and the ion will grab hold of the electrons. In contrary, Cl^- ion will move to..... (20) electrode and the ion will set electrons free. The effect of the electron's movement results the electric current, and consequently the light is on. In the electrolyte solution, the function of ion is to send..... (21)
The substance which is dissolved in the solution (solutes), can conduct electricity, and is called ***electrolyte substances***. While the substance, which cannot conduct electricity is called ***non-electrolytes substances.***

Conclusion:
ELECTROLYTE SOLUTION is the solution which ..... (22)
NON ELECTROLYTE SOLUTION is the solution which ..... (23)

C. MODEL OF LEARNING BY CONSTRUCTIVISM APPROACH

Based on the research in designing model of learning by constructivism approach (Ellizar. 2008) , the steps were:



First, teacher distribute the module for each student, then explained how to learn chemistry by using module. Teacher asked question about the concept that have related with the topic that day, so the previous concept already recall. Then teacher asked the student to work with LKS in module. After student finish with first LKS, teacher change student work-sheet, and distribute the key answere. The student looks for a friends' misconception and told the teacher. If more than 5 students make a mistake on the same concept, the teacher will explain the concept for student. So miss conception is identified. After understand the concept, they will continue with work exercise. This time, each student can evaluate their understanding by looking for the key answered after finish their work exercise. The process will continue for the second LKS and so on.

D. THE BENEFITS OF CONSTRUCTIVISM

The advantages of constructivism are :(www.thirteen.org/edonline/concept2class/constructivism/index_sub6.html)

1. Children learn more, and enjoy learning more when they are actively involved, rather than passive learners.
2. Education works best when it concentrates on thinking and understanding, rather than on rote memorization. Constructivism concentrates on learning how to think and understand.
3. Constructivist learning is transferable. In constructivist classrooms, students create organizing principles that they can take with them to other learning setting.
4. Constructivist gives students ownership of what they learn, since learning is based on students questions and explorations, and often the students have a hand in designing the assessment as well. Constructivist assessment engages the students initiatives and personal investments in their journals, research report, physical models, and artistic representations.
5. By grounding learning activities in an authentic, real world context, constructivism stimulates and engages students. Students in constructivist-classroom learn to question things and to apply their natural curiousity to the world.
6. Constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Student must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projecs. Students must negotiate with others and to evaluate their contributions in a socially acceptable manner. This is essential to success in real world.

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