Sharing and Jumping Task Based Lesson Design of Conservation of Mass Concept

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Abstract:
This research aims to develop a lesson design in sharing and jumping task of conservation of mass concept. This lesson design based on learning obstacle of high school student and teacher’s self-reflection. The method used in this research was qualitative research method. The research subjects were students of grade X and XI in one of high school in Bandung. The Instrument that used were a test, observation sheet, interview guideline, and documentation. Research findings indicate that the identified learning obstacles were students did not understand the meaning of conservation of mass and students have obstacle looking at the concept of mass, they thought in a chemical reaction mass of solid is greater than the liquid mass, and the mass of the gas is not considered. Student’s learning obstacles were identified as a basis for designing the lesson design. This lesson design contained of sharing and jumping task activities. Lesson design was implemented twice. In the first implementation, there were still many teacher’s involvements in the activities of sharing task and time management for jumping task activities was not arranged well. Lesson design that has been implemented in the first class then revised to be implemented in the second class. The revision lesson design was adding a chemical substance used in the lab practice activity. In the second implementation, students were more active in sharing and jumping task activities. It was because self-reflection of teachers to reduce teacher’s involvement in student group activities. The results of the implementation of lesson design showed that reduced learning obstacle of high school student on the concept of conservation of mass.

Keyword: Lesson Design, Sharing and Jumping Task, Learning Obstacle, Conservation of Mass

1. INTRODUCTION

The Strategic Plan of the Ministry of Education and Culture 2015 - 2019 show that not sufficient good in term of learning quality in Indonesia, both measurement from the learning process and results of student learning. The government has sought many steps to improve the quality of teaching in Indonesia, one of them with the development of curriculum 2013. Minister of Education and Culture of the Republic of Indonesia Education (2014) explained that learning process on the curriculum in 2013 is using a scientific approach that touches three domains, they are: attitude, knowledge, and skills. With the learning process as it, is expected to produce students which are productive, creative, innovative, and affective through the strengthening of attitudes, skills and integrated knowledges.

In fact, the learning process is still a lot things that is not fit with the expected demands of the curriculum 2013. Baswedan (2015) said that from the various studies, the learning process in the classroom generally does not run interactively so it can not foster creativity, critical thinking, and analytical skills of students.

Correspondingly, based on the observations that have been done in one of high schools in the city of Bandung, the learning process was not run interactively. Teacher transfer knowledges by explaining and giving examples in class, and the students only listened, wrote, then did the exercises given by the teacher. Some students was losing focus in learning, it was identified because there was unreasonable attitudes or behaviors that are inappropriate in the learning process. For example, when a teacher was
explaining the material there was a student who fall asleep, some of the boys made a fuss in the classroom so the teacher had to move the seat of students to the floor in the front row so they were more focused to the teacher's explanation. There were student who the divided the focus of his eyes between drawing and paying attention to the teacher in front of the class during the learning process.

When the teachers gave assignments to students, there were some students who were very slow in understanding and working on the task, so the teacher had to guide the students personally in front of the class from the start until the end of the work. When teachers was guiding these students, other students returned no attention and showed behavior that does not reflect an interest in learning by doing other things outside of learning such as playing cell phones and chatting outside learning topics with friends.

A learning atmosphere like that will cause obstacles for students in understanding concepts in chemistry materials. One of the most fundamental chemistry concepts is the conservation of mass, but there is some studies that show learning obstacle that experienced by the students in understanding the concepts of conservation of mass.

Bachelard in Mortimer (1995) explains the existence of epistemology obstacles in respect of the concept of the mass. Mass is associated only to things that are big and heavy. So it is difficult to connect the mass with subtle substances such as air and other gases.

The results of research conducted by Ramsden (1997) also shows that conservation of mass is generally poorly understood. This is shown when students are given questions about mass conservation law in chemical precipitation reactions, half of the number of students gave wrong answers and did not give an explanation on the answers. There are some students who gave an explanation, but the explanation was wrong because it considers the sediment will be heavier, examples of student’s answers as follows: (1) The sediment is a solid, and weighs more than the liquid. (2) The Solids that formed has a greater density than the liquid. So the weight of the solids will be slightly heavier than liquid. So the weight of the solids will be slightly heavier than liquid. One-third of the students who answered wrong, thought that mixing the two solution to make a sediment involving the formation of gas, which is leading to a decrease in mass. A small number of other students provided an explanation that involves evaporation such as: some liquid will evaporate but not too much.

Ozmen & Ayas (2003) conducted a study aimed at investigated the student's understanding of conservation of mass in a chemical reaction that occurs in open and closed systems. The findings showed that half the students from grade ten to understand the conservation of mass in a chemical reaction of the mass before the reaction is equal to the mass after reaction. Half of them have a misconception. Some students do not realize that the mass of the solution is equal to the mass of dissolved substances and solvents. Here are some of the opinions of the students most commonly found in this study: (1) solid is heavier than gas, (2) when the phosphorus soluble in water weighs disappeared, (3) the resulting sediment is heavier than liquid, (4) when a chemical combustion occurs in a closed system, the mass of the overall decline.

Learning obstacles on conservation of mass concept has to be overcome, because the law of conservation of mass is a very basic and fundamental law, and it is also associated with other chemistry materials such as chemical equations. One of the ways that can be done to overcome the learning obstacles is by constructing the lesson design. The lesson design was organized collaboratively in the development of materials, design framework, and the provision of learning resources with teachers or experts.

The purpose of this study is to develop a lesson design of conservation of mass corresponding to the identified learning obstacles and teacher self-reflection.

2. RESEARCH METHODOLOGY

Research methods used in this research is qualitative research methods. Research done in one high school in the city of Bandung. The subject in this study is the students from class X and Class XI. Chemistry teacher, a teacher model, was the teacher who teach in the classroom that has been set as the
class of the subject, namely teachers collaborate with researchers as team teaching. The instruments used are a test (Tes Kemampuan Responden), interview guidelines and observation sheets.

3. FINDING AND DISCUSSION

Learning obstacle on the concept of conservation of mass is obtained based on the results of the analysis of the findings from the student's answers on test and the results of the interviews students. The test consisted of 6 questions. Based on the overall results of test, learning obstacle identified were students did not understand the meaning of the law of conservation of mass and students have obstacle looking at the concept of mass, the students thought in a chemical reaction mass of solid is greater than the liquid mass, and the mass of the gas is not considere. Student’s learning obstacles were identified as a basis for designing the lesson design. This lesson design contained of sharing and jumping task activities. In the activity of sharing task there is a sharing material in accordance with the curriculum and should be understood by all students and on the activity of jumping task there is jump material that exceeds the level of the curriculum (Sato, 2013).

At the beginning in the design of learning activities, the teacher would be demonstrate a chemical reaction between vinegar acid and baking soda. Preparation of initial activity on learning design is based on one of the learning obstacle that is already identification students not taking into account the mass of the gas in a chemical reaction. When Vinegar CH₃COOH (aq) and baking soda NaHCO₃ (s) is reacted, they will produce CH₃COONa (aq) + H₂O (l) + CO₂ (g). In this demonstration the teacher used a tool such as Y tube, balloon, spatula, pipette, measuring cups, and digital scales. The balloon is used as the cap Y tube, so when vinegar and baking soda is reacted, the balloon expands, indicates that the existence of gas produced. When the weighing is done, mass of substance before the reaction will be the same as the mass of matter after the reaction. From the demonstration, students are expected to understand that the gas has a mass and the mass of the gas have been taken into account.

Demonstration used material in the form of vinegar and baking soda is aimed to increase the interest and attraction to the students at the beginning of the learning process because the material close to the everyday lives of students. This is in line with the statements expressed by Nuridawani et.al (2015) that learning that starts from things that are close to the daily lives of students to its concrete will make students interested in learning so that learning occurs on an active and dynamic.

The purpose of the demonstration by Purnawirawanti et al (2013), are: (1) students are able to understand about how to arrange or compose something. (2) Students can watch the work of a tool or object. (3) Students can observe the section part of an object or tool. (4) when the students do it yourself, then he can also understand the use of a tool. Thus through the demonstration conducted by the teacher, the students are able to understand the expected tools and practical work steps, so students have no trouble on core activities, namely at a time when students do practical work themselves.

The next student activities are given in the sharing task activities in this activity students do practical work and discussions in small groups. Muchindasari (2016) said that in the process of learning expected of students got the experience to build the concept so that learning is not a teacher-oriented but more focused on students. Responsibility teachers strive to enable students in learning so that students acquire concepts rather than memorization or simply transfer the science but rather through the process. It is in line with the goals expected by researchers. Researchers hope by using the method of teaching and learning, small group discussions focused on students and through such activities the students can acquire and prove themselves the concept of conservation of mass that the mass before the reaction is equal to the mass of the after reaction.

The preparation of these activities is based on the student's learning obstacles which has identified as students do not understand the meaning of the law of conservation of mass and students obstacle in respect of the concept of mass, students thought that in a chemical reaction are considered solid masses greater than the mass of the liquid. Therefore, designed an experiment that reacting two solution are NaOH (aq) and CuSO₄ (aq) and the reaction of the two solutions resulted precipitate Cu (OH)₂ (s) and Na₂SO₄ (aq). From this experiment, students are expected to find the concept that mass before reaction is
equal to the mass after reaction, although the reaction products already formed precipitates in the form of solids. Through learning like that enables students to discover the concept of conservation of mass itself, expected students not only memorized designation of the conservation of mass, but truly understand the meaning of the conservation of mass. After conducting the experiment, students would wrote down the observations, reactions equation and conclusions on the student worksheet as well as accomplish the task given. The tasks given in the form of the application of the mass conservation law in the calculation.

At the end of the activity, students are given the jumping task activities. At the end of this activity, students expected to deeply understand that in all chemical reaction mass after reaction is equal to the mass before reaction. In this activity, students were given several questions. These questions are questions with high-level cognitive level and including the high-level cognitive level into the analysis, evaluation and synthesis (Kasilingam, et. al, 2014). The first question talks about the rust of iron. student are given the phenomenon that rusted iron mass greater than the mass of iron before rusty.

Students are asked to explain whether this phenomenon is corresponding the conservation of mass and how to prove those reactions. Small group students discuss the answer of these question well. After that, the students discuss and report the results of the answer, next the teacher will give the reinforcement that the actual reaction of iron rust in accordance with the law of conservation of mass. If found the phenomenon of mass before and after reaction is different, there must be a mass of substance that that are not accounted for in these chemical reactions. In this phenomenon is the mass of a substance is not taken into account is the mass of a gas that reacts, so the mass before and after the reaction is different. This question also relates to student's learning obstacle who only focus on the solid mass alone while the mass of the gas is not taken into account. Therefore the teacher is giving the reinforcement that the gas involved in the chemical reaction has a mass. If the mass of the gas involved in the reaction is taken into account then the mass before reaction will be equal to the mass after reaction. Then the students were given a question again that is why in a chemical reaction that mass does not change (mass before reaction is equal to the mass after reaction)?! Students are asked to discuss in small groups. Based on the overall design of the existing activities in the lesson design, expected to overcome all the learning obstacles that have been identified. Based on the overall design of the existing activities in the lesson design, expected to overcome all the learning obstacles that have been identified.

Lesson design that have been developed implemented in grade X.1. On the activity of sharing task, collaboration student in the group has been going well, but there are still many teacher’s involvement in the group, this was due to confusion in the students in writing tools and materials and also confusion in writing down the equation of the reaction. On the activity of Jumping, according to Sato (2014) if all students can work on problem of jumping task properly, it means the problema is too easy, reasonable level that can be attained by students in work on the problems of jumping is half the task or one third of the students in the class. Findings indicate, time management in jumping task activity hasn't done well. No group who were able to answer the first question jumping task properly. All groups responded that the reaction of rust of iron not include conservation of mass and that no group who can explain how to prove it. For the question why the mass in a chemical reaction does not change?, no students who were able to provide the desired response is that the mass in a chemical reaction does not change because the atoms in chemical reactions is not changed just a rearrangement occurs, this corresponds to dalton's postulates. But there are some students who responded that because elements in the chemical reaction remains the same even though new substance is formed, and just changes phase.

After implementation, re-test is conducted. From the results of the test and interview the students found that learning obstacles have been reduced but still exist. Teachers conduct self-reflection toward the learning that has been held. Then, lesson design that has been implemented in the class X.1 revised to be implemented in the class X.2. The revision lesson design was adding a chemical substance used in the lab practice activity. Substances which are added is substances Pb (NO<sub>3</sub>)<sub>2</sub> (aq) and KI (aq). Based on the results of the reflection of teachers, there are several improvements in the learning process, the teacher will reduce its involvement in group activity, as well as improve the way confirm the observations of students. In the second implementation, students were more active in sharing and jumping task activities.
In jumping task activity, the findings indicate that there are two groups who stated that iron rust reaction in accordance with the law of conservation of mass. But no group gave correct answers related to how to prove the reaction of rust in accordance with the law of conservation of mass. For the question about why the mass in a chemical reaction does not change?, no students who can give an answer with associate with Dalton's postulates. However, there is group of students who associated it with the chemical equation must be equal. From the test results, show that reduced learning obstacles, no more students who wrote down the answer that the mass of sediment or solids would be heavier than liquid, but still there are students who do not take into account the mass of the gas in a chemical reaction that was still wrong answer.

4. CONCLUSION

Learning obstacle as the impact of the implementation of lesson design has decreased. Thus the lesson design can minimize the appear of learning obstacles related of conservation of mass concept, therefore this lesson design can be one of alternative learning of conservation of mass concept for high school.

5. REFERENCES