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## Use Of Used Goods (Waste) As Learning Media For Materials And Energy Topics In Basic Chemistry Courses At Jambi University

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### Info Article

Received: 3 Jul 2019

Revised: 17 Aug 2019

Accepted: 17 Sep 2019

OnlineVersion: 20 Sep 2019

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### Abstract

This classroom action research uses a simple experimental demonstration method focused on matter and energy in a basic chemistry course. The samples were several basic chemistry classes at the Faculty of Engineering, Jambi University. The aim of this research is to improve the teaching and learning process in basic chemistry classes at Jambi University. Specifically, this research aims to produce simple experimental procedures about energy and matter to be applied in basic chemistry learning, as well as getting reflections on the strategies and methods of these experiments on the learning process and student learning outcomes. After cycle III was completed, a posttest was carried out to evaluate students' understanding, with an average posttest score of 79, which met the minimum completeness criteria ( $\geq 70$ ). With positive results in cycle III, it can be concluded that the indicators of success in action have been achieved, seen from the increase in learning outcomes and student activities from cycle to cycle.

Keywords: Basic Chemistry; Learning Media; Matter and Energy

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## INTRODUCTION

Research by Nakhleh (1992), Pendley, Bretz, and Novak (1994), and Hadiat (1994) highlighted the difficulties in learning chemistry caused by abstract concepts that are difficult to understand directly. This is exacerbated by teaching approaches that tend to only encourage students to memorize without developing creative thinking skills in solving chemical problems. At Jambi University, especially in basic courses such as Basic Chemistry, problems such as inadequate laboratory facilities are often encountered. However, Nazarudin and Sutrisno (2003) have proven that the use of used materials in experiments, such as in understanding simple distillation, can increase students' understanding and their learning motivation. The same thing is also supported by research by Dogru et al. (2011) which shows that simple experiments can improve students' understanding. Likewise, research by Othaman et al. (2012) who found that experimental activities in the laboratory can increase students' interest in learning chemistry. Thus, implementing practical and innovative approaches in chemistry learning is important to improve the quality of the teaching and learning process.

The concept of the learning by doing educational method, which was popularized by the American philosopher John Dewey in the 20th century, emphasizes direct experience in learning. This is in contrast to education which only emphasizes remembering (memorization) lessons. This approach creates a learning structure that combines the use of the five senses and the mind together, resulting in a

complete understanding. Focusing on the learning process helps students not only connect with facts or data that can be accessed through the five senses, but also organize these facts or data with the mind. (Severa et al., 2010).

Learning in natural sciences (science), including chemistry, involves concepts, research/experiments, and observations which should be presented in class so that students can easily understand them. Demonstration of chemistry experiments, such as those regarding physical properties and chemical reactions, encourages students to ask questions about the relationship between previous understanding and the facts they observe during the experiment (Gunstone and Champagne, 1990). By using process skills strategies and methods, the teaching and learning process is expected to encourage students to discover concepts and theories through independent activities (Soetarjo and Soejitno, 1998). Research by Nina Kadaritna et al. (2000) at SMU YP Unila Bandar Lampung showed that the process skills approach through experimental methods increased student interest and learning outcomes in chemistry lessons.

Specifically, this research aims to: (1) Produce a simple experimental procedure on the topic of energy and matter to be applied to the basic chemistry learning process. (2) Get reflections on strategies and methods of simple experimental procedures on the topic of energy and matter on the learning process in class. (3) Get a reflection on the relationship between strategies and methods of simple experimental procedures on the topic of energy and matter on student learning outcomes. (4) After the learning process in cycle III is complete, another posttest is held to determine the extent of students' understanding of the concepts of matter and energy.

## **RESEARCH METHODS**

### ***Research Design***

. This research is classroom action research. The action that will be taken in this research is a simple experimental demonstration method focused on the subject of matter and energy in basic chemistry courses.

### ***Research Target/Subject***

This research aims to evaluate the effectiveness of simple experimental demonstration methods related to the topic of energy and matter in increasing students' understanding of basic chemical concepts. The research subjects were odd semester students in basic chemistry courses at the Faculty of Engineering, Jambi University. Subjects were taken using purposive sampling techniques for qualitative data and census techniques for quantitative data. This research will combine qualitative and quantitative data to provide a comprehensive understanding of the effectiveness of the learning methods used.

### ***Research Procedure***

This research procedure uses a classroom action research (PTK) approach with an experimental design. The steps include problem identification, action planning based on the results of initial test analysis, implementation of actions such as simple experimental demonstrations, observation of the learning process, reflection after each cycle, and evaluation through analysis of initial and final test results. This research aims to gain an in-depth understanding of the effectiveness of the simple experimental demonstration method in increasing students' understanding of the concepts of energy and matter in learning basic chemistry.

### ***Instruments, and Data Collection Techniques***

The instruments and data collection techniques used in this research include a pre-test and a post-test to measure students' understanding of the concepts of energy and matter in basic chemistry. Apart from that, learning plans are also recorded to evaluate the relationship between planning and implementation of learning. Observations are carried out to record the learning process in class, while feedback from students and reflections on actions will also be a source of data. By using these various instruments and techniques, it is hoped that complete and comprehensive data can be obtained to evaluate the effectiveness of learning methods in increasing students' understanding of the concepts of energy and matter in basic chemistry..

### *Data analysis technique*

The data analysis techniques used in this research will include quantitative and qualitative analysis. Quantitative data from the results of the initial test and final test will be analyzed using descriptive statistical methods to evaluate students' level of understanding. Meanwhile, qualitative data from observations of the learning process, student feedback, and reflections on actions will be analyzed thematically to understand interactions between lecturers and students, as well as the effectiveness of the learning methods used. The integration of quantitative and qualitative data will provide a holistic understanding of the effectiveness of simple experimental demonstration methods in increasing students' understanding of the concepts of energy and matter in basic chemistry.

## **RESULTS AND DISCUSSION**

In this research, several aspects were developed, including (1) the Constructivism Method where demonstrations and questions and answers can enable students to develop their own concepts of understanding about what matter and energy are. (2) the learning process in this case is developing a simple experimental method that is environmentally friendly (where this simple experimental equipment uses used items found in the student's environment) and discussing the results of the experiments carried out as well as practicing questions as feedback for students, (3) pretest, posttest and journal assignments from simple experiments carried out to support students' understanding of the topic of matter and energy. (4) Evaluation techniques are carried out at the end of each action cycle to assess student learning achievements and as a reference in implementing the next cycle for improvement. Assessment of the results of the pretest, posttest and journaling are used as references to the extent to which students have achieved the expected competencies, so that the learning process can continue. If the results of the first pretest, posttest and journal-making assessments are low (average  $<70$ ) then more examples of simple demonstrations will be added in class, then the second stage test will be carried out again. If the average has reached  $>70$ , then learning continues in the next action.

The material presented in this cycle is in the form of knowledge about the topic of matter and energy. The method used in this cycle is a lecture where the lecturer gives examples of natural phenomena that occur on this earth, then students together conclude the concept of matter and energy. Alone. In this cycle, a pretest is carried out to determine students' understanding of this topic. From the results of observations on the learning observation sheet and student observation sheet (attached questionnaire) during cycle I, it was found that student learning activity data in this cycle students were quite active because there was a two-way discussion between lecturers and students, students were required to think and imagine how the concepts The material and energy are due to the actions carried out in this cycle. Then the students are asked to give their arguments in front of the class, then the results of several of their arguments make conclusions about the material studied.

Before the learning process in cycle I begins, a pretest is carried out to measure the extent of students' knowledge about the topic to be discussed. From the test results, it was found that the average student score was 58 and the number of students who met the specified study completion criteria ( $\geq 70.0$ ) was only 8 out of a total of 49 students or around 16%. When viewed from classical learning completeness, the results of the actions in cycle I have not shown satisfactory results because the completeness is still below 80%. After the learning process in cycle I is complete, students are then asked to keep a journal to determine the students' ability to understand the material that has been discussed. From the results of the journal assessments made by students in cycle I, the average student score was 71 and the number of students who met the learning completion criteria set by the campus (score  $\geq 70$ ) was 38 people or 77.5%. The learning value achieved in this cycle has not shown satisfactory success because it is still below 80%.

If you look at the learning observation sheets and student observation sheets, the psychomotor/learning activity scores of students in class have not been achieved because only a few children are actively asking questions and giving arguments while the other children are just silent and just accepting the information obtained during the learning process. It also appears that students are not very orderly during the learning process. By evaluating the learning activities obtained in cycle I, there needs to

be improvements in implementing cycle II, including by motivating more and presenting the material in a more interesting way.

In cycle II, the lecturer makes a presentation in front of the class and uses several macromedia flash learning media related to matter and energy. Based on observations made by observers during cycle II, data was obtained that students seemed more active in learning activities because the lecturer displayed several animations on the topics of matter and energy being studied. Students' enthusiasm is seen to be higher. Analysis of students' readiness to learn activities, learning motivation and students' activities of asking, answering questions, and actively presenting their arguments in cycle II shows that students' misconceptions about matter and energy have reduced although there are still doubts among some students. This increase in activity shows a change in students' motivation and interest in studying chemistry courses after seeing animations on the topic of matter and energy. Based on the results of the analysis of activities and learning outcomes in cycle II, improvements are needed in the management of the learning process, including by inviting students to carry out direct experiments.

The learning process takes place as in cycles I and II with improvements to several learning techniques according to the results of reflection in cycle II. In cycle III, the lecturer carries out a direct demonstration in front of the class using used items that can still be used in conducting experiments. The results of observations in cycle III obtained quite good data and student activities. Students looked very enthusiastic when the demonstration was held in front of the class, several students were directly involved in the demonstration in front of the class. This shows that student interest and motivation is very high in this cycle. From the observation component carried out by the observer, it shows that students are increasingly interested in chemistry, this is shown by the increase in the number of students who provide arguments during questions and answers during demonstrations.

The formative test (pretest) was carried out at the beginning of cycle III to determine the extent to which students understood the concepts of matter and energy that had been discussed previously. From the results of this test, an average score of 63 was obtained (Table 2), although this result did not reach the desired results (80% of students obtained a score  $\geq 70$ ), but when compared with the average score of previous learning results. After the learning process in cycle III was completed, another posttest was held to determine the extent of students' understanding of the concepts of matter and energy. From this posttest, an average score of 79 was obtained (Table 2). It can be seen that the average score for this posttest has met the minimum completeness criteria, namely  $\geq 70$ . The results obtained in cycle III mean that the indicators of success of the action have been achieved, when viewed in terms of increasing learning outcomes and student activities from cycle to cycle. Overall, it can be said that developing learning through simple experimental methods using used goods from the surrounding environment can foster student interest and motivation in learning.

Based on this research, it can be said that the use of used materials in the surrounding environment in chemistry learning at the Faculty of Engineering, Jambi University can improve student test results, so this method can be said to be effective in improving student learning outcomes. The results of this research are not much different from the results of previous research (Nazarudin and Sutrisno, 2003) which also conducted research using used materials to support students' understanding of the simple distillation process. The results of the research show positive results, namely that students can understand the distillation process better, and students are more motivated to learn by utilizing materials found in the surrounding environment.

## CONCLUSION

Based on the results of the research and discussion, it can be concluded that the application of simple experiments on the topic of matter and energy is effective in the basic chemistry learning process. This research shows that this simple experimental method can be applied successfully in the context of basic chemistry learning at the Faculty of Engineering, Jambi University. The research results show an increase in test results and student learning activities after implementing this method, indicating that this method can increase student understanding and participation in the learning process. Therefore, it can be

concluded that the use of simple experimental methods regarding matter and energy can be an effective alternative in improving basic chemistry learning in academic environments such as the Faculty of Engineering, Jamb University.

#### ACKNOWLEDGMENTS

We would like to express our deepest thanks to all parties who took part in this research.

#### REFERENCES

- Bare, W. O., Goldsby, K. A., Duffy, D. Q. & Shaw, S. A. 1995. More Chemistry in a Soda Bottle: A Conservation of Mass Activity. *Journal of Chemical Education*, 72, 734-736.
- Derr, B. J., Derr, H. R. & Lewis, T. 2000. Gas Me Up, or, A Baking Powder Diver. *Journal of Chemical Education*, 77, 171-172.
- Doğru, M., Gençosman, T. & Ataalkın, A. 2011. Examination of Natural Science Laboratory Perception Levels of Students at Primary Education Grade 6 and Their Attitudes Towards Laboratory Practices of Natural Science Course. *Educational Research Association The International Journal of Educational Researchers* . 2 17-27.
- Gunstone, R. F. & Champagne, A. B. 1990. *Promoting conceptual change in the laboratory. The student laboratory and the science curriculum*, 159-182.
- Hadiat 1994. *Pendekatan Sains Teknologi Masyarakat di Indonesia* Jakarta: Dirjen Dikdasmen Pusat Pengembangan Penataran Guru IPA.
- Kadaritna, N., Sunyono, Sungkowo & Haria Ety, S. M. 2000. *Penggunaan Pendekatan Keterampilan Proses dalam Upaya Meningkatkan Pemahaman Konsep Kimia pada Siswa Kelas II SMU YP Unila Bandar Lampung Tahun Pelajaran 1999/2000*. Laporan Penelitian Tindakan Kelas. Bandar Lampung: Proyek PGSM Dikti., Universitas Lampung.
- Nakhleh, M. B. 1992. Why some students don't learn chemistry: Chemical misconceptions. 69, 191.
- Naoki Kanda, Asano, T. & Ltoh, T. 1995. Preparing "Chameleon Balls" from Natural Plants, Simple Handmade pH Indicator and Teaching Material for Chemical Equilibrium. *Journal of Chemical Education*, 72, 1131-1132.
- Nazarudin, Kamid & Marsal, J. 2014. *Pemanfaatan Barang Bekas Untuk Percobaan interaksi Antara Materi dan Cahaya; Demonstrasi Media Percobaan di SMPN5 Kota Jambi*. Jambi: Universitas Jambi.
- Othaman, R., Badri, K. H., Hanifah, S. A., Zakaria, Z., Yang, Aziz, F. A. & Daik, R. 2012. Chemistry outreach program and its impact on secondary school students. *Procedia - Social and Behavioral Sciences*, 59, 692-696.
- Pendley, B. D., Bretz, R. L. & Novak, J. D. 1994. Concept Maps As a Tool To Asses Learning in Chemistry. *Journal of Chemical Education*, 71, 9-15
- Severa, S., Yuromezoglua, K. & Oguz-Unvera, A. 2010. Comparison teaching strategies of videotaped and demonstration experiments in inquirybased science education. *Procedia-Social And Behavioral Sciences*, 2, 56195624.
- Snyder, C. A. & Snyder, D. C. 1992. Simple Soda Bottle Solubility and Equilibria. *Journal Of Chemical Education*., 69 (7), 573., 69, 573.
- Soetarjo & Soejitno, P. 1998. *Proses Belajar Mengajar dengan Metode Pendekatan Keterampilan Proses*, Surabaya, Penerbit: SIC.
- Solomon, S., Hur, C., Lee, A. & Smith, K. 1996. Synthesis of Ethyl Salicylate Using Household Chemicals. *Journal of Chemical Education*, 73, 173.
- Sutrisno & Nazarudin 2003. *Pemanfaatan Barang Bekas Sebagai Media Pengajaran Pokok Bahasan Udara, Orbital Molekul dan Senyawa Logam Komplek di SMU Untuk Meningkatkan Hasil Belajar Siswa*. Laporan Penelitian Jambi: Universitas Jambi.