The Effect of Context-Based Chemistry Learning on Student Achievement and Attitude

Ahmad Nurkholis Majid[1,*], Eli Rohaeti[2]

[1]Chemistry Education, Master's Programme, Yogyakarta State University, Yogyakarta 55281 INDONESIA
[2]Departement of Chemistry Education, Faculty of Matematics and Natural Sciences, Yogyakarta State University, Yogyakarta 55281 INDONESIA
*Corresponding author: ahmad.nurkholis2016@student.uny.ac.id

Abstract Many countries have implemented context-based learning in the last 20 years. Through this context-based learning, students are taught learning materials that are relevant to everyday life. This research is an experimental research with posttest only design. The purpose of this study was to examine the effect of context-based learning on student achievement and attitudes on acid-base material. The result of the research shows that there is an influence of context-based chemistry learning on student achievement and attitude.

Keywords: *context-based learning, achievement, attitude, acid base, 5 E model*

1. Introduction

Chemical learning is a part of science learning that is important in studying the phenomena that exist in nature. Various symptoms and phenomena that appear can be seen from a chemical point of view. In essence, the phenomenon has existed before people learn chemistry, only just revealed or can be learned after the scientists produce various kinds of research and make chemistry as we know it today. Based on the results of TIMSS, PIRLS and PISA there are still many problems in science learning. Difficulties in applying scientific knowledge and low interest in scientific studies become one of the major challenges in teaching chemistry. many teachers complained about the low interest of students in learning chemistry (Ilhana, Yildirimb, Yilmazc, 2016) [1].

According to Espinosa, Monterola & Punzalan (2013) the facts of the field show that students start a chemistry class with lots of hope, questions, and big interests that are unsustainable because they think the subject is too abstract and mathematical, although chemistry essentially becomes one of the important sciences in various industry and also a science that many applications in everyday life (Magwilang, 2016) [2]. Student perceptions arise because learning in the classroom is focused on theory alone without being directed to link learning content with real life. One of the things that must be done by teachers in tackling the negative perceptions of students is to make the learning is carried out relevant to the life of students, not least in the study of chemistry. Among the things that teachers should be able to explain to students is the reason why students should learn the material taught and their usefulness in the daily life of the students. It is not easy to explain to the students, if the teacher is still focused on content learning, without explaining the context further in the student's life.

According to King & Ritchie (2012) [3] that over the past two decades, context-based chemistry learning programs have been developed and implemented in international schools in an effort to improve the linkage of chemical concepts that are integrated into the real lives of students. In the present study of chemistry is much directed to relate to everyday life. Learning that only theory alone produces the subject of learning to be dry and seem abstract. The result will change the students' motivation and attitude toward the learning of chemistry and also about the chemical-related viewpoint itself. Therefore awareness to bridge between events in daily life with chemical content leads to the need to interpret chemical topics in everyday life, to be used as learning materials in class. The context-based curriculum has developed in many countries in recent years, among the countries that apply the curriculum to the United States, Great Britain, the Netherlands and Canada (Acar & Yaman4 2011) [4].

Context-based learning is a learning aim to connect the students' daily knowledge with the content that they learn in school. Whitelegg & Parry (1999, p.65) [5] describes the functioning context in actual classroom practice: At the broadest level context means the social and cultural environment in which students, teachers, and institutions reside. One further definition is given by (Bennett & Lubben; 2006) [6] which focuses on that the existing context should tell students to appreciate and understand the chemical contribution to their lives and provide a way to gain a better understanding of the world, thereby specifically specified as following:

.. the lesson units should begin with the aspects of student life, which they experience either personally or through the media, and should introduce ideas and concepts only to the needs of students (Campbell, 1994) as quoted in Bennett & Lubben (2006).

In context-based learning, the starting point is construction in real-world situations, with learning closely related to student life, so that knowledge gained will feel more meaningful.

Context-based learning has become one of the trends in chemical education research in recent years. Many studies have been conducted to investigate their impact on different dependent variables such as Bennett & Holman (2002), Campbell & Lubben (2000), Fensham (2009), ilhana (2011) and Schwartz (2006). Ideally the implementation of learning in the classroom in addition to using learning approaches, also used varied learning models. However, in the case of context-based learning has not been much integration with existing models, the research that has been done mostly still only implementation of context-based approaches in isolation, without integration with various learning models that fit the characteristics of context-based learning, such as research undertaken by Ilhana et al (2016) and research from Magwilang (2016).

Many learning models that can be used in the implementation of context-based learning include learning cycle 5 E. As is known in choosing a model at least there are 4 main components that must be ignored are the syntax, social systems, reaction principles and carrying capacity. In the learning cycle 5 E model syntax is suitable for use in context-based chemistry learning, because of its stages will guide the students towards the conceptual knowledge of everyday life. Similarly, in the principle of reaction and social systems that can improve the activity of students in finding out the relationship of the concept with the relevant context and support is also possible to be applied in various high schools that have a laboratory or not.

A context-based approach is an approach that can improve student achievement, motivation and attitude, this has been proven by several types of research such as Fatma (2014), Magwilang (2016) and Ilhana (2016). Motivation and attitudes become important in improving student achievement, because with the motivation and a positive attitude in following the learning automatically the student will try to catch what is delivered by the teacher in the learning done, in addition to the positive attitude and good motivation, students will try more to find out related material taught, so that indirectly affect student achievement. Traditional concept-based approaches are still a favorite in syllabus and curriculum documents. Perhaps because teachers and curriculum developers remain unsure of the benefits of context-based programs. Further research on the implementation of context-based learning is needed to understand more fully the circumstances in which students relate classroom concepts and context and how the outcomes of context-based approaches to teachers and students (King, 2013) [7]. Particularly in Indonesia the curriculum used has not been formally focused on context-based learning, especially in chemistry learning whereas students' complaints related to abstract chemical learning are also not much different from students from other parts of the world

Learning achievement is influenced by many factors, besides motivation and also attitudes among influential factors in learning achievement are the initial understanding of students. According to Thompson & Zamboanga (2003) [8], early understanding will affect students' achievement in learning, although it is still relatively relative, but with this initial understanding will lead to the forthcoming learning process. Many studies have not considered the initial knowledge factors of students when examining student achievement. Though the initial understanding becomes a variable that may be very influential on achievement.

The student's attitude toward learning becomes an integral part of student achievement. This is in accordance with research conducted by Weinburgh (1995) [9] concluded that there is a correlation between attitudes toward science and student achievement both men and women. Freedman (1997) [10] also found that the correlation between attitudes toward science and achievement as well as Salta & Tzougraki (2004) [11]. Many students have ugly achievements in a subject due to a non-positive attitude in the subject, including in chemistry lessons.

Researchers are interested in implementing context-based chemistry learning because it is deemed necessary to be tested further regarding the benefits of this learning, especially how it affects students' achievement and attitudes toward chemistry. This is to strengthen research in various countries that have been and will direct the context-based curriculum on chemistry learning, and especially for Indonesia, there are still very few who try to apply or study this context-based learning, so it is necessary to be tested with the condition of Indonesian students.

2. Methode

2.1. Research Design

This study included in a quasi-experimental design with posttest only design. The variable of this research consist of the independent variable that is context-based learning with dependent variable is student achievement and attitude.

2.1.1. Population and Sample

The population of this study is all the eleventh graders of natural science in indoesia. The sample in this research is 64 student students from region Bumiayu Central Java. Sampling technique in this research is by cluster random sampling technique. Cluster random sampling is a method of sampling based on a group of individuals and not taken individually or from a population of class eleventh graders of natural science took two classes at random which then used as experimental class and control class.

2.1.2. Data Collection Techniques

The Data collection techniques in this study through documentation, examination, questionnaire, interview, and

observation sheet. The instruments of data collection in this study using test instruments and non-test instruments. The test instrument in the form of multiple choice questions amounted to 35 questions to clarify student's cognitive achievement on acidic base material with reliability value of person realibity 0.44 and o.73 for item using cronbach's alpha coefficient. Grain validity was measured using rasch modeling with fit items determined by 3 criteria described by boone et al (2014), ie outfit-means squere, outfit z staandard and point mesure correlation. Based on the results of the analysis, obtained item fit with rasch model of 29 questions from 35.

The non-test instrument in the form of an attitude questionnaire, the student attitude instrument on chemistry learning was obtained from an instrument developed by Cheung (2009) who developed 12-item samples for 954 chemistry students in Hong Kong. The internal consistency reliability of the instrument is adequate with chronbach's alpha value for four sub-scales ranging from 0.76 to 0.86. Confirmatory factor analysis results show that there is a suitability between the hypothetical model and the observed data (eg, goodness-of-fit index = 0.95, normed fit index = 0.95, comparative fit index = 0.96).

2.1.3. Data Analysis Process

1. review existing literature related to independent variables and dependent variables
2. determine the object to be studied
3. make lattice grid about test and non test
4. determine the population and sample to be tested
5. specify the experiment and control classes
6. performing pretest on experiment and control classes
7. implementing learning in the classroom
8. do postes on experiment and control classes
9. analyze the data obtained

3. The Result of Research

3.1 Result of Normalitas

Before performing the hypothesis analysis, a prerequisite analysis is performed first. The prerequisite analysis test consists of a test of normality, linearity, and homogeneity. After the data is declared normal, hypothesis analysis can be done using parametric statistics. In this research hypothesis analysis technique using MANOVA.

Before performing the analysis using MANOVA, it is first required that the data be normally distributed. Based on the regression analysis obtained correlation coefficient obtained 0.985 and significance 0.000. <0.05 shows a very high correlation coefficient. The magnitude of the correlation coefficient between -1 and +1. If the correlation coefficient> r table or sig value. <0.05 then there is a significant correlation

3.1.1. Results Belong to Descriptive Statistics

Postest student achievement result and student attitude questionnaire scores of experimental and control groups we presented in Table 1.

Table 1. Results for Posstest Scores

Scale	Groups	N	Mean	SD
Achievement	Experimental	33	60.60	7.724
	Control	31	55.39	1.037
Attitude	Experimental	33	72.45	7.44
	Control	31	54.76	1.230

According from Table 1 the result posstest student achievement, the mean score for the experimental group 60.60 was higher than the control group 53.08. similarly from the achievement, attitude of the students in the experimental class shows a greater result than the control class, that is control class 54.76 <72.45

3.1.2. Result Of Multivariate Analysis

Based on data analysis using SPSS software obtained data as follows (Table 2)

Table 2. Multivariate Test

Test	F	sig	Partial eta squere
Wilks'Lambda	25.019	0.000	0.987
Pilar's Trace	25.019	0.000	0.987
Hotelling Trace	25.019	0.000	0.987
Roy's Largers Root	25.019	0.000	0.987

Through the simultaneous analysis in Table 2 there was a significant difference between the two variables tested (achievement and attitude) reviewed by context-based chemistry learning (F = 25,019; p <0.05). context-based learning explains the effect size of 0.987 which shows an effective contribution in explaining the three variable is 99 percent.

3.1.3. Univariate Comparison Results

After looking at multivariate analysis result, univariate data analysis needs to be seen. The following is the univariate analysis results presented in Table 3

Table 3. Univariate Test

Dependent Variable	F	sig	Partial eta squere
Achievment	5.247	0.000	0.078
Attitude	47.642	0.000	0.434

The results of the analysis separately indicate that there are differences in student achievement using context-based learning (F = 5.247; p <0.05). Contextual learning is able to explain the variance in achievement of 0.078 (7.8%). The same results were also found in the student attitude aspect, where the analysis separately showed that there were differences in students' attitudes using context-based learning (F = 47.632; p <0.05). Contex based learning is able to explain the variance in student attitudes of 0.434 (43.4%).

3.1.4. Discussion

This study aims to examine the effect of context-based learning with 5 E cycle learning model on student achievement and attitudes. Based on the results of the descriptive analysis shows that between the experimental class and the control class there is an average difference

(both in achievement aspect and student attitude aspect). The results of the descriptive analysis indicate that the experimental class (M = 60.60) has a higher mean value than the counter class (M = 55.39), indicating that student achievement in the class using context-based learning is better than the control class. The same result was also found in the attitude aspect, where the mean score of students' attitude in the experimental class (M = 72.45) was greater than the students' attitude aspect in the control class (54.76), indicating that the students' good compared to a class that does not use it.

In this study, the impact of context-based learning with 5 E cycle learning model on student achievement and attitude compared via MANOVA. According on (Table 2) there was a significant difference between the two variables tested (achievement and attitude) reviewed by context-based chemistry learning with 5 E model learning (F = 25,019; p <0.05). context-based learning with 5 E model learning explains the effect size of 0.987 which shows an effective contribution in explaining the three variable is 99 percent.

The impact of context-based learning with 5 E cycle learning model on student achievement was examined via findings obtained by achievement test. When achievement test post scores were compared via univariate test context-based learning with 5 E cycle learning model contributed more to students' success than 5 E cycle learning model without context based learning without context-based learning see on (Table 3). The results of this study support the results of previous studies on the positive effects of context-based teaching on students' achievement such as research conducted by (Ingram, 2003; Bennett & Lubben, 2006; Kutu & Sözbilir, 2011).

Based on Table 3 on attitude aspect, context-based learning using learning cycle 5 E also has significant influence, it can be seen from the value (F = 47.632; p <0.05). Contextual learning is able to explain the variance in student attitudes of 0.434 (43.4%). The results of this study support the results of previous studies on the positive effects of context-based teaching on students' achievement such as research conducted by (Ramsden, 1997; Gutwill-Wise, 2001; Demircioğlu, Demircioğlu, & Çalık, 2009).

Motivation and attitudes become important in improving student achievement, because with the motivation and a positive attitude in following the learning automatically the student will try to catch what is delivered by the teacher in the learning done, in addition to the positive attitude and good motivation,

The student's attitude toward learning becomes an integral part of student achievement. This is in accordance with research conducted by Weinburgh (1995).

Context based learning has been shown to influence student achievement and attitude both from multivariate and univariate analysis. Through context-based learning attitude of students will be positive, because students assume that the content of the material delivered relevant to the daily life of students, in addition students feel know the usefulness konsp that is taught by the teacher in life, so the spirit of learning and addressing the content of the material tend to be positive

4. Concussion

Through the simultaneous analysis with MANOVA there was a significant difference between the two variables tested (achievement and attitude) reviewed by context-based chemistry learning (F = 25,019; p <0.05). context-based learning explains the effect size of 0.987 which shows an effective contribution in explaining the three variable is 99 percent.

Acknowledgements

References

[1] İlhan, N., Yildirin, Ali., Yilmaz, S. *"The Effect Of Context-Based Chemical Equilibriumon Grade 11 Students'learning, Motivation and Constructivist Learning Environment,"* International Journal Of Environmental & Science Education, 11(9), 3117-3137. Jun2016.

[2] Magwilang, E. B. *"Teaching Chemistry In Context: Its Effects On Students' Motivation, Attitudes and Achievement in Chemistry,"* International Journal of Learning, Teaching and Educational Research, 15 (4). 2016.

[3] King, D. T. *"New Perspectives on Context-Based Chemistry Education: Using A Dialecticalsociocultural Approach To View Teaching and Learning".* Studies in Science Education, 48(1), Retrieved from 51-87. Feb2012.

[4] Acar, B. & Yaman, M.. *The Effects Of Context-Based Learning On Students' Levels Of Knowledge And Interest.* Hacettepe University Journal of Education, 40, 1-10. 2011.

[5] Whitelegg, E., Parry, M.). *Real-Life Contexts For Learning Physics:* Meanings, Issues, and Practice. Physics Education*, 34*(2), 68-72. 1999.

[6] Bennet, J., & Lubben, F)." *Context–Based Chemistry: The Salters Approach*." International Journal of Science Education, 28(9), 999-1015. Jul 2006.

[7] King, D. T., & Ritchie, S. M. *"Academic success in context- based chemistry: Demonstrating fluid transitions between concepts and context*." International Journal of Science Education, 35(7), 1159-1182. Mar2013.

[8] Thompson & Zamboanga. *"Prior Knowledge and Its Relevance to Student Achievement in Introduction to Psychology".* Journal of Educational Psychology 96(4): 778-784. Dec 2004.

[9] Weinburgh, M. (1995). *Gender Differencesi in Student Attitudes Toward Science: A Meta-Analysis of Theliteratur*e from 1970 to 1991. Journal of Research in Science Teaching, 32, 387-398. 1995.

[10] Freedman, M. P. Relationship Among Laboratory Instruction, Attitude Toward Science, And Achievement. 34(4), 343-357. 1997.

[11] Salta & Tzougraki. *"Attitudes toward chemistry among 11th grade students in high schools in Greece".* Wiley Periodicals, Inc. Apr 2004.