ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research (ASSEHR), volume 227
1st International Conference on Advanced Multidisciplinary Research (ICAMR 2018)

The Effect of using Interactive Students' Worksheet on Learning Achievement and Students' Perception in The Basic Chemistry Course (Study on Reaction Rate)

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***Abstract*—This research is quasi-experimental research that aims to determine the effect of using Interactive Student Worksheet (ISW) on learning achievement and students perceptions of Chemistry Education Study Program of Makassar State University in basic chemistry courses on reaction rate topic. The research population was all of the students of Chemistry Education Program who participate basic chemistry courses consisting of three classes. The research sample was chosen randomly and selected as the control class was the education class A and the experimental class is the education class B and C. The data were analyzed using the SPSS program. The results showed the use of ISW has a positive effect on learning achievement and students perceptions on the reaction rate of a basic chemistry course. The average grade of students learning achievement that taught using ISW and classes taught without using ISW are 71.25 and 58.37, respectively. The average score of student perceptions of learning in classes ISW and classes taught without an ISW is 68.81 and 64.39, respectively.**

Keywords—interactive student worksheet, learning achievement, student perception

I. INTRODUCTION

Basic chemistry course is an essential course for all chemistry students. Basic chemistry courses underlie other chemistry courses. If students can master in this course; then they will find it easier to study other chemistry courses. The amount of material covered in basic chemistry courses is very large while the available time of learning is very limited. Therefore, lecturers are required to design a new lectures note/materials in such a way that students can master the lecture material well. One way is to use the right learning media.

One of the learning media that can be used is student worksheet. A student worksheet is teaching materials that are packaged in such a way that students can learn lecture material independently. Using student worksheet, students will get a summary of course material and tasks related to the course material. In addition, students can also find structured directions to understand the course material provided. In other words, at the same time, students are given materials and tasks related to the material [1]. Thus the constraints of lack of time due to a large number of course materials can be overcome with the use of student worksheet. Furthermore, student worksheet can also help students to understand of course material. In order to be used more effectively by the student because the worksheet is made to be interactive. Interactive student worksheet (ISW) can be used by students both in class and outside the classroom. Students can get feedback directly when they use the ISW.

The implementation of basic chemistry courses is usually in the chemistry department of FMIPA Universitas Negeri Makassar can generally be divided into three stages, namely the introduction, core, and closing stages. Moreover, in the introduction stage students are prepared to attend lectures by giving motivation and apperception. In the core stage usually begins with the presentation of the learning material by the lecturer, then followed by giving questions that are done independently, in groups, or in classics. At the closing stage, the lecturers and students review and conclude the learning material that has been studied.

Giving of ISW can be done at the giving questions. The ISW beside containing questions also contained a review of material in the form of videos and text. The number of questions and types of questions is also more varied. In this study, two classes that have the same average ability will be compared. One class is given an ISW while the other class does not use an ISW. Using an ISW are expected to influence learning achievement and student perceptions on the topic of the rate reaction of basic chemistry course.

Student achievement is measured by giving a test of learning achievement in accordance with the learning indicators. Student perception is obtained by giving a questionnaire after learning is given. Perception is a picture of something that is received through our senses. Opinions are built based on the object's reality and the knowledge that was previously owned [2]. Perception questionnaire includes: *first*, the requirements of effective learning activities [3] and time constraints [4] which include: student involvement, students' responsibilities, feedback, effective student activities, and all essential material covered; *second*, increased thinking ability [5][6][4] which includes: the attainment of critical thinking (making decisions based on

existing components, assessing the conclusions of others, seeing for yourself based on what is known about the given situation , analyzing arguments and exploring deeper definitions and interpretations, developing logical reasoning and understanding assumptions based on certain circumstances) and creative thinking (realizing creative abilities, encouraging new ideas, encouraging openness, encouraging learning needs, increasing problem solving, using concepts that known to make various possibilities, encourage the original perspective);*third*, debriefing concepts of the rate of reaction [7] which include: needed, understandable, reasonable, useful.

II. Research Methodology

This research is a quasi-experimental study with the *Posttest-Only Control Design*. The population is consist of 3 classes with a total of 123 students. Two of the class were chosen as an experimental class and one class as a control. The independent variable is learning the reaction rate topic using ISW and learning the reaction rate topic without ISW, while the dependent variable is learning achievement and perception of students. Research is conducted in the even semester of the 2017-2018 academic year. ISW are made using Macromedia Flash 8 Pro.

The instrument used in this study is a test of chemistry learning achievement and student perceptions questionnaire. Learning achievement test is a cognitive aspect test in the form of multiple choice questions. This test consists of 20 multiple choice questions in accordance with the learning indicators that was validated by an expert. Questionnaires of students' perceptions of learning are given to know their opinions about learning. Data analysis was carried out using the SPSS program. If the data obtained is normally distributed, the test is done by independent t-test. If the data is not nominally distributed, it is done by the Mann-Whitney test.

III. Results and Discussion

Basic competencies of the rate reaction topic are: Students understand the concept of reaction kinetics, the factors that influence reaction kinetics and their application in daily life [8]. Indicators of learning the topic of reaction rates are: explaining the definition of chemistry reaction rate, determining mathematical relationships between the reaction rate based on the reaction and the rate of reaction based on the reaction results, investigating the factors (concentration, surface area, temperature, and catalyst) that affect the rate of reaction and concluding the results, analyzing experimental data to determine the reaction order, using the basic postulate of collision theory to explain dependent rate of reaction on several factors that influence the rate of reaction, and explains the application of the concept of the rate of reaction in daily life and industry.

TABLE I. Descriptive Data of Students Learning Achievement on Reaction Rate Topics

	Experiment Class	Control Class
Mean	71.25	58.39
Variance	74.774	214.371
Std. Deviation	8.647	14.641
Minimum	56	32
Maximum	88	80

Descriptive data of student learning achievement can be seen in Table 1. The results of the normality test of learning achievement for the experiment class and control class are presented in Table 2.

TABLE II. The Result of Normality Test of Students Learning Achievement

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Learning Achievement	Experiment	.209	32	.001	.920	32	.021
	Control	.116	33	.200*	.941	33	.074
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

The results of normality test of students learning achievement data for experimental class obtain ρ=0.001 (Kolmogorov-Smirnov test) and ρ=0.021 (Shapiro-Wilk test) while for the control class obtained ρ=0.200 (Kolmogorov-Smirnov test) and ρ=0.074 (Shapiro-Wilk test) The data shows that at the level of confidence of α=0.05 the students learning achievement data in the experimental class are not distributed normally and the data in the control class are distributed normally. Because there is data not distributed normally, the test is done using the Mann-Whitney test. Mann-Whitney Test results are presented in Table 3. From these data, it can be seen ρ=0.000, thus the ranking of students learning achievement of classes taught that using interactive ISW is significantly higher than the class not taught using ISW. It can be concluded that there is a positive influence on the using of interactive student worksheet on student learning achievement of the reaction rate topic in basic chemistry courses.

TABLE III. Mann-Whitney Test of Student Learning Achievement

	Learning Achievement
Mann-Whitney U	252.500
Wilcoxon W	813.500
Z	-3.645
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: Kelas	

In the experimental class is used conventional learning and using ISW, while in the control class is used conventional learning without using ISW. Learning can be divided into three stages, namely: introduction, core, and closing. In the introduction, stage are prepared students to be ready and take apart in learning by giving apperception and motivation. At the core stage, starting with giving lectures is then followed by giving examples of problems to students. At the experimental class, the questions were given in the form of ISW, while in the control class was given problems in written form. ISW contain varied questions, namely: multiple choices, crossword puzzles, matchmaking, and right and wrong. In addition, ISW also contains learning material, essence material, glossary, video, and animation (Fig. 1).

Fig. 1. Interactive Student Worksheet (ISW) Support Menu

ISW can be used by students both in class and outside the classroom. This causes students to be more active and more motivated in learning. Studies of the development of ISW in chemistry learning have been carried out at the secondary school level [9]. They showed that the use of ISW provides better learning. In chemistry learning in universities, the use of ISW is still rarely carried out.

TABLE IV. DESCRIPTIVE DATA OF STUDENT PERCEPTIONS OF LEARNING OF REACTION RATE TOPIC

	Experiment Class	Control Class
Mean	68.81	64.39
Variance	34.35	35.121
Std. Deviation	5.86096	5.92632
Minimum	58.00	53.00
Maximum	81.00	76.00

Descriptive statistical tests for student perceptions of learning on the topic of reaction rates in the basic chemistry courses for the experiment class and control class are presented in Table 4. The normality test of student perceptions on topic rate reaction can be seen in Table 5.The results of the normality test for experiment class obtained ρ=0.200 (Kolmogorov-Smirnov) and ρ=0.733 (Shapiro-Wilk) while for the control class obtained ρ=.200 (Kolmogorov-Smirnov) and ρ=0.740 (Shapiro-Wilk). At the level of confidence the α=0.05, student perceptions of learning of the topic of in the experiment class and control class are normally distributed.

TABLE V. NORMALITY TEST OF STUDENTS PERCEPTION

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Perception	Exp Class	.080	32	.200*	.978	32	.733
	Cont Class	.081	33	.200*	.978	33	.740
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

The t-test results of student perceptions data on learning of the reaction rate topic can be seen in Table 6. From these data, it can be seen that student perceptions data in the experimental class and the control class obtained ρ=class on learning have homogeneous variances (Levene's Test) with 0.899. = 0.002 (1-tailed) and smaller than 0.05.ρ = 0.004 (2-tailed) or ρIndependent t-test shows From this data it can be seen that significantly the perception of students in the class taught using interactive MFIs is higher than the class taught without using an interactive MFI. It can be concluded that there is a positive influence of the use of interactive MFIs on student perceptions on the topic of reaction rates in basic chemistry courses.

TABLE VI. THE RESULT OF INDEPENDENT T-TEST OF STUDENT PERCEPTION ON LEARNING OF REACTION RATE TOPICS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Perception	Equal variances assumed	.016	.899	3.022	63	.004
	Equal variances not assumed			3.022	62.974	.004

There are four points that are the objectives of the preparation ISW, namely: making it easier for students to interact with the lecture material, presenting tasks to improve student mastery of lecture material, training student learning independence, and facilitating educators in assigning tasks to students [1]. The various uses of ISW are: helping students develop concepts independently so that they learn according to their own pace, training students to find and develop process skills through a combination of images and text, as a guide for lecturers and students in

carrying out the learning process, helping students to obtain information about concepts learned through a systematic learning process, and helping students to obtain material notes learned through learning activities, specifically on programmed text, students will actively participate because they must respond to questions and exercises, material can be reproduced economically and easily distributed [10]. This is what makes ISW affect toward learning achievement and student perceptions of the rate reaction in basic chemistry courses in Chemistry Education Study Programs of the Chemistry Department, Mathematics and Natural Science Faculty of Makassar State University.

IV. Conclusion

The results of the study can be summarized as follows: there is a positive effect of the using of Interactive Student Worksheet(ISW) toward learning achievement and perceptions of students on rate reaction topic of Chemistry Education Program of Chemistry Department of Mathematics and Natural Sciences faculty of Makassar State Universities. The average grade of students learning achievement that taught using ISW and classes taught without using ISW are 71.25 and 58.37, respectively. The average score of student perceptions of learning in classes ISW and classes taught without an ISW is 68.81 and 64.39, respectively.

V. References

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