

Interactive e-module using Zoom Cloud Meeting platform to reduce misconceptions on salt hydrolysis material

Maria Erna, Lenny Anwar, Mazidah

Master Program of Chemistry Education, Faculty of Teacher Training and Education, Universitas Riau, Indonesia

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ABSTRACT

This study aimed to determine the effectiveness of using an interactive e-module to reduce students' misconceptions on Salt Hydrolysis material at grade XI in senior high school. This study implemented a pre-experiment with one group pretest-posttest research design, which utilized one class as the experimental class. Samples were selected by using purposive sampling technique, and it was obtained one class as the experimental class, namely class XI in State Madrasah Aliyah 1 Pekanbaru, Riau, Indonesia. Before giving the treatment, the sample was administered a pretest and after the treatment, they were given a posttest. The pretest and posttest questions occupied three-tier multiple choice questions. The reduction of misconceptions on Salt Hydrolysis material after using the interactive e-module was 16.21%. The study found that interactive e-modules effective to reduce misconceptions on salt hydrolysis material was significant.

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Corresponding Author:

Maria Erna

Master Program of Chemistry Education, Faculty of Teacher Training and Education
Universitas Riau

Jl.HR.Soebrantas, Km, 12,5, Pekanbaru, 28293, Indonesia

Email: mariaerna@lecturer.unri.ac.id

1. INTRODUCTION

Learning in the 21st century combines knowledge, thoughts, innovation skills, media, literacy, information and communication technology (ICT) and real-life experiences in the learning process. This combination allows to stimulate and encourage students to focus on achieving value or meaning to develop new skills [1], [2]. The 21st century is marked by the development of information technology [3]. The integration of technology in all areas of life causes the human interaction increasingly reliant on technological developments, indicated by the increasing interaction of humans with computers and the internet. As a result, changes occur rapidly and unpredictable in all aspects of life, such as the fields of knowledge, economy, transportation, technology, communication, education and others [4], [5]. Advances in science and technology have an effect on the use of teaching aids at schools and in other educational institutions. At this time, learning at schools begins to be adjusted to the development of science and technology, which results in changes and shifts in the educational paradigm. In order for effective teaching to occur, a teacher must provide various ways to address all students' learning needs [6]; one of which is by using information technology.

Using information technology for learning has become a necessity and demand in the globalization era [7]. Technology helps students learn self-extracting information skills, actively use cognitive structures from memory, thinking, imagination, and can be designed for intensive personality development in terms of students' organizing processes [8]. In accordance with the demands of 21st century learning, students must be capable of solving various problems by thinking creatively and using technology [1]. Each student has a

different ability to solve problems, especially the ability to discuss a concept. Students possess a concept carried as initial knowledge, which is called preconception. The students' preconceptions are sometimes different from the actual concept according to experts. For example, the students have different conceptions in accepting the concept, so it is possible that some students have a wrong conception towards a concept; this is called misconception [9]. Misconceptions can occur due to differences in the construction of knowledge of each individual and environment (peers, family, society, literature, teachers, and teaching methods) [10]. The students' misconceptions may result from the students themselves, teachers, textbooks, contexts, and learning methods. In addition, there are certain subject characteristics that are difficult for students to understand so that students try to interpret or create their own concepts. This sometimes does not match the actual concept; as a result, it creates wrong concepts in the minds of students [11].

In this study, students' misconceptions were investigated in the chemistry subject, particularly on salt hydrolysis by using a three-level multiple choice diagnostic test [12]. This test was chosen for it involved three levels of questions. The first level was an ordinary multiple-choice question while the second level stated the reasons for the answers at the first level. Finally, the third level included students' confidence in the answers given on the two previous levels [13]. The students who answered correctly and were sure of their answers indicated that they really understood the concept learned. Meanwhile, the students who were sure of the answer even though the answer was wrong showed that they had a misconception. On the other hand, the students who answered erroneously and were not sure of the answer implied that they did not experience a misconception, but lack of knowledge. The advantages of a three-level multiple choice diagnostic test are that it can: 1) Diagnose misconceptions experienced by students more deeply; 2) Determine parts of the material that require more emphasis during learning; 3) Plan for better learning to help reduce students' misconceptions [14]. Salt hydrolysis material was chosen as the object in this study because this material not only was limited to clearly observed concepts (concrete concepts) but also discussed abstract and complex concepts, as well as concepts involving symbolic representations [15].

Many attempts have been conducted to reduce misconceptions, such as studies conducted by implementing the cognitive conflict approach [16], the use of animation modules and media [17], the development of discovery-inquiry learning models [18], the use of interactive multimedia [19], and application of the predict, discuss, explain, observe, discuss, and explain (PDEODE) collaborative strategy [20]. Unfortunately, these studies have not shown significant results to reduce material misconceptions. In this study, the implementation of interactive e-module with Zoom Cloud Meeting platform was carried out to reduce students' misconceptions on online learning. It was hoped that this e-module could be implemented as an independent learning resource to help students improve their cognitive competence or understanding. E-Module eased the students to learn a material since it was easy to carry anywhere and anytime [21]-[23].

In this study, the E-module was designed by using the Kvisoft Flipbook Maker application program. This program was used because its digital publication document view looks like a digital magazine which was varied, innovative, and efficient [24]. This application assists the learning process due to its features focusing not only on writings but also motion animations, videos, and audios which allow interactive and interesting learning media; as a result, the learning process is no longer monotonous [25]. The results of this study can be implemented in learning in the current pandemic conditions (COVID-19) which have affected the world including Indonesia. As the world health authorities, WHO has emphasized to stop outdoor activities and activities involving the crowd, including face-to-face learning that gathers a large number of students in the classroom [26]. For this reason, using digital technology allows students and teachers to perform the distance learning in which both students and teachers conduct the learning process from home [27]. A form of learning that can be used as a solution during the COVID- 19 pandemic is online learning using interactive e-module media products so that teachers can present information in innovative ways and can motivate students to study harder [28].

2. RESEARCH METHOD

This study was conducted at State Madrasah Aliyah 1 Pekanbaru, Riau, Indonesia in the even semester of the academic year 2019/2020. The method of this study was a pre-experimental research method with one group pretest-posttest research design [29]. In this design, the sample was given a pretest before the treatment and a posttest at the end of the study. The pretest was administered to determine the students' initial ability on salt hydrolysis material. After that, the students were taught by using interactive e-module teaching materials, and at the end of learning, the students were given a posttest to determine their final ability after using interactive e-module teaching materials in the learning process. The pretest and posttest questions utilized three-tier multiple choice questions. The research design can be seen in Table 1.

Table 1. The design of one group pretest-posttest

Subject	Pre Test	Treatment	Post Test
1 group	O ₁	X	O ₂

Note:

O₁ : pretest score before giving the treatment

X : treatment

O₂ : posttest score after giving the treatment

The population in this study was students of grade XI at State Madrasah Aliyah 1 Pekanbaru while the samples were 33 students at grade XI in State Madrasah Aliyah Pekanbaru who were selected by using purposive sampling technique. The misconceptions were determined by using the following methods.

2.1. Scoring

The assessors of multiple-choice questions at level I and II were carried out by using the scoring shown in Table 2.

Table 2. Score item points

Types of Questions	Score	Remark
Three-tier multiple choice	1	If the answer is correct
	0	If the answer is incorrect

2.2. The analysis of students' misconception identification test

The data of this study were quantitative data derived from the results of three-tier multiple choice diagnostic test. Based on these results, the sample was grouped into four categories. They are the students: 1) Who knew the concept; 2) Who did not know the concept; 3) Who guessed; and 4) Who experienced misconceptions. This grouping was made for each question [30]. For more details, the criteria of this grouping are displayed in Table 3.

Table 3. Criteria for grouping students' conceptions

Level 1	Level 2	Level 3 (CRI)	Decision
Correct	Correct	Sure	Knowing the concept
Correct	Correct	Not Sure	Guessing
Correct	Incorrect	Sure	Misconception
Correct	Incorrect	Not Sure	Guessing
Incorrect	Incorrect	Sure	Misconception
Incorrect	Incorrect	Not Sure	Not Knowing the concept
Incorrect	Correct	Sure	Misconception
Incorrect	Correct	Not Sure	Guessing

2.3. Calculating the percentage

The number of samples who had a concept were converted into a percentage based on the analysis of written test data by using the formula:

$$\%KC = \frac{KC}{N} \times 100\% \quad (1)$$

$$\%NKC = \frac{NKC}{N} \times 100\% \quad (2)$$

$$\%MC = \frac{MC}{N} \times 100\% \quad (3)$$

$$\%GA = \frac{GA}{N} \times 100\% \quad (4)$$

Note:

KC = the group of students who know the concept

NKC = the group of students who do not know the concept

MC = the group of students who show misconceptions

GA = the group of students who guess the answer

N = the number of students

The effectiveness of using this e-module was calculated by using SPSS V 23. Hypothesis testing in this study was conducted by using Wilcoxon test. If the value of Asymp.Sig. (2-tailed) was less than <0.05 , H_a was accepted. The confounding variable in this study is that the internet problem is resolved by sending an e-module file via a flash disk before learning to use Zoom Cloud Meeting is carried out.

3. RESULTS AND DISCUSSION

Data of this study were quantitative data derived from the results of three-tier multiple choice diagnostic test. Based on these results, the samples were grouped into four categories: 1) Students who knew the concept; 2) Students who did not know the concept; 3) Students who guessed the answer; and 4) Students who experienced misconceptions. This grouping was made for each question. To be clearer, the criteria for this grouping can be seen in Table 3. Furthermore, the data used to determine the results of misconception reduction was the difference between the misconception percentage of posttest and pretest. This difference showed a decrease in misconceptions before and after learning about salt hydrolysis by using interactive e-modules.

3.1. Grouping misconceptions data

The results of grouping misconceptions in this study are presented in Table 4. It can be seen that of the 20 questions given shows a decrease in student misconceptions for each question. This happens because students when learning online using the zoom cloud meeting platform can interact with the teacher effectively.

Table 4. The percentage of students' misconceptions in pretest and posttest

Item No	Misconceptions before treatment	Misconceptions after treatment
1	30.30%	15.15%
2	33.33%	27.27%
3	21.21%	6.06%
4	39.39%	21.21%
5	33.33%	15.15%
6	36.36%	21.21%
7	39.39%	30.30%
8	39.39%	18.18%
9	33.33%	12.12%
10	51.51%	33.33%
11	45.45%	33.33%
12	48.48%	21.21%
13	45.45%	21.21%
14	33.33%	18.18%
15	39.39%	24.24%
16	42.42%	27.27%
17	36.36%	24.24%
18	39.39%	21.21%
19	36.36%	24.24%
20	39.39%	24.24%

3.2. The amount of misconception reduction

The amount of misconception reduction was utilized to see how much the reduction of misconceptions from the use of interactive e-module teaching materials on salt hydrolysis material at grade XI in State Madrasah Aliyah 1 Pekanbaru. Table 5 displays that the reduction of misconceptions of using interactive e-module teaching materials on salt hydrolysis at grade XI in State Madrasah Aliyah 1 Pekanbaru was 16.21%. A previous study was conducted by Purnamawati, *et al.* [31] found that there was a reduction in misconceptions through the application of E-Module based on Problem-Based Learning on ecology material for 47.18% at grade X in Batik high school 1 Surakarta.

Table 5. The percentage of misconception reduction

Item No	Pretest	Posttest	Reduction
1	30.30%	15.15%	15.15%
2	33.33%	27.27%	6.06
3	21.21%	6.06%	15.15
4	39.39%	21.21%	18.18
5	33.33%	15.15%	18.18
6	36.36%	21.21%	15.15
7	39.39%	30.30%	9.09
8	39.39%	18.18%	21.21
9	33.33%	12.12%	21.21
10	51.51%	33.33%	18.18
11	45.45%	33.33%	12.12
12	48.48%	21.21%	27.27
13	45.45%	21.21%	24.24
14	33.33%	18.18%	15.15
15	39.39%	24.24%	15.15
16	42.42%	27.27%	15.15
17	36.36%	24.24%	12.12
18	39.39%	21.21%	18.18
19	36.36%	24.24%	12.12
20	39.39%	24.24%	15.15
Average	38.17%	21.96%	16.21%

The reduction of misconceptions occurred because e-modules presented independent learning materials that were systematically arranged into the smallest learning units in order to achieve certain learnings presented in electronic formats such as animations, audios, and navigations which allowed users to be more interactive with the program. Electronic media accessed by students had different benefits and characteristics. From the benefits view, electronic media could make the learning process more interesting and interactive. Besides, it could be done anytime and anywhere, and it improved the quality of learning. As a result, it reduced students' misconceptions [32]. The cover of interactive e-module product on salt hydrolysis is seen in Figure 1.

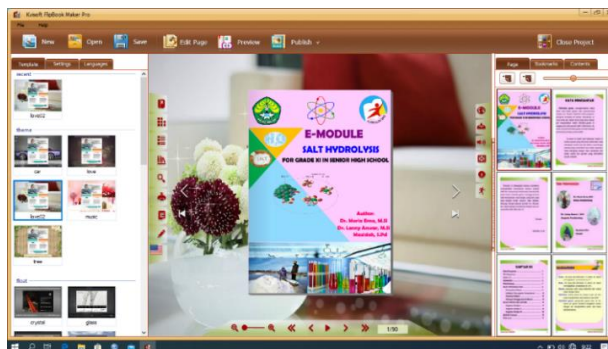


Figure 1. Cover of e-module on salt hydrolysis

3.3. The effectiveness of e-module

The effectiveness aspect of e-module towards misconceptions was seen from the increase of the scores in pretest and posttest by using three-tier multiple choice questions on salt hydrolysis material before and after using e-module. The analysis of the normality test from pretest and posttest classes was conducted by applying the Shapiro Wilk test. The normality test was done to find out whether the data in pretest and posttest were normally distributed or not. These data can be seen in Table 6.

Table 6. Normality test

Group	Kolmogrov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Misconceptions pretest	0.143	33	0.083	0.952	33	0.151
Misconceptions posttest	0.156	33	0.039	0.955	33	0.181

a. Lilliefors Significance Correction

Table 6 demonstrates that the score derived from pretest and posttest for the experimental class had a sig value as much as 0.151 and 0.181 respectively, meaning that the score from the pretest and posttest were normally distributed because the data had $\text{sig} > 0.05$. Thus, data for hypothesis testing was conducted by a T test in which H_a was accepted if the p value (asympt. Sig 2 tailed) was less than the critical research limit as much as 0.05.

Based on the results of t-test, p value was obtained (asympt. Sig 2 tailed) for as much as 0.000, so that the hypothesis decision was H_a accepted. There was a significant increase for grade XI students at State Madrasah Aliyah 1 Pekanbaru before using interactive e-modules and after using e- interactive module on salt hydrolysis material, this can be seen in Table 7.

Table 7. Statistical test

	Levene's Test for Equality of Variances		T	df	t-test for Equality of Means				
	F	Sig.			Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Equal variances assumed	0.874	0.353	-26.661	64	0.000	-49.0909	1.8413	-52.7694	-45.4125
			-26.661	62.067	0.000	-49.0909	1.8413	-52.7716	-45.4103
Equal variances not assumed									

This study revealed that the e-module was effective to be implemented in the learning process. This was because the application of ICT in a learning field was believed to be able to improve students' learning abilities; one of which was using the e-modules [33]. Applying ICT in the learning process would positively affect students' learning outcomes [34]. Moreover, learning by using media had a positive effect on students' learning outcomes and it could reduce the students' misconceptions because students could directly see the abstract learning through the display of videos and animations on e-modules used in learning [35].

4. CONCLUSION

Based on results and discussion, the p value was (asympt. Sig 2 tailed) 0.000, so that H_a was accepted, meaning there was a significant increase of the students at grade XI in State Madrasah Aliyah 1 Pekanbaru before and after using interactive e-modules on salt hydrolysis material. Furthermore, it also reduced students' misconceptions on salt hydrolysis material. The percentage of misconceptions reduction after using the interactive e-module on salt hydrolysis material at grade XI in State Madrasah Aliyah 1 Pekanbaru was 16.21%.

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BIOGRAPHIES OF AUTHORS



Maria Erna was born in Dalu-Dalu Riau, Indonesia, in 1972. She is an Associate Professor at the Department of Chemistry Education, Universitas Riau. Her research interest is focused on developing learning media based on lesson study as a learning community and application of Information and Communication, Technology (ICT) to chemistry learning. She has published articles in national and international journals. ORCID iD: 0000-0001-5644-7598.



Lenny Anwar is a senior lecturer in the Chemistry Education Department of Chemistry Education, Universitas Riau, Indonesia. Her research interest includes: developing model and media of learning based Information and Communication, Technology (ICT) and applied chemistry (email:lennyanwar@lecturer.unri.ac.id). ORCID: 0000-0002-0507-2893.



Mazidah is student of master program of chemistry education Fkip, Universitas Riau. Born in Kh. Mandah 20 November 1994, is the son of Mr. Ramli and Mrs.Zainab. The formal education taken is SDN 047 Pandan Sari, Mandah sub-district, graduated in 2007. After that continued to MTSN Mandah, graduated in 2010. Then continued to MAN 1 Pekanbaru, graduated in 2013. In the same year was accepted at the existing college in Pekanbaru, namely UIN SUSKA Riau, graduated in 2017. Then in 2018 continued the master program in chemistry education at the University of Riau.