The Study of Chemistry Learning on The Material of Buffer Solution Supported by Teaching Material of Multiple Representation-Chemoentrepreneurship Viewed From Student Entrepreneurship Interest

A Drastisianti[1], E Susilaningsih[2], Supartono[3], and N Wijayati[4]

[1]Natural Science Study Program, Graduate Program, Universitas Negeri Semarang, Indonesia
[2,3,4]Chemistry Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia
[1]Corresponding email: apriliana.adda@gmail.com

Abstract

Teaching and learning activities in the classroom are part of the educational process aimed at bringing to a better state. These activities will be more meaningful if the needs and experiences of students are considered. Thus, this can improve the learning objectives which is connecting the subject matter subject to real-world problems. The purposes of this research are (1) to get student response toward teaching materials of multiple Representations-Chemoentrepreneurship (entrepreneurship in the chemistry field) and (2) to know and describe the influence of entrepreneur interest toward student learning outcomes. This research is the mixed method using by the model of sequential explanatory. Research subjects were 114 students from eleven grade of natural science class (XI MIPA 3, XI MIPA 4, and XI MIPA 5), state senior high school 12 (SMA Negeri 12) Semarang, academic year 2017/2018. Quantitative data obtained through a three-tier multiple choice test. Qualitative data collected through questionnaires to determine the response of students towards teaching materials and through questionnaires. Based on this data, we can assess of student entrepreneur interest. The teaching material was validated by three validators and it obtained very feasible results with an average score of 190.33 from 212. The average score of the response sheet questionnaire was 29,500 with good category and Alpha Cronbach reliability results of 0.871. Reliability of entrepreneurial interest questionnaire is 0.935. The results of this study indicate that entrepreneur interest of student influences on student learning outcomes (t_{count} 10.811 > t_{table} 1.660).

Keyword : Chemistry Learning, Material Buffer Solution, Chemoentrepreneurship

1. Introduction

Improving the quality of education can not be separated from the variety of teaching and learning activities in the classroom. Teaching and learning activities in the classroom are part of the educational process aimed at bringing to a better state. Learning activities in the classroom will be more meaningful if the needs and experiences of students are considered. One of the efforts taken is with learning that can develop student skills. Students have the opportunity to optimize their potential for producing the product so that student entrepreneur interest will grow (Supartono, Wijayati and Sari, 2009). Interests are one of the internal factors that affect the process and student learning outcomes, so it needs to be strived for achieving optimal learning outcomes. Innovative learning of chemistry will enhance students' interest and motivation to enrich learning experiences and transfer knowledge. Learning with Chemoentrepreneurship (entrepreneurship in the chemistry field) approach connected directly to the real object so that students are expected to be more understanding of chemistry lessons that contain abstract concepts.

Characteristics of abstract chemistry lessons cause students to have difficulty understanding concepts so that students will make their interpretations of the concepts learned (Sendur, Toprak, & Pekmez, 2010). The fundamental concepts must be interpreted correctly before understanding more complex concepts (Maghfiroh, Santosa & Suryadharma, 2016). Therefore, it is necessary to understand the concepts that are directly related to daily life so that students can learn the material more easily.

This can be done through the introduction of objects by direct observation, describing them at the molecular level, and explaining them in the form of symbols and chemical formulas. Multi-representation is needed by students to understand and develop the concept (Ainsworth, 1999). Tuysuz et al., (2011) stated that the learning chemistry involves three levels: macroscopic, symbolic, and microscopic The macroscopic aspect is real and contains visible chemicals, including the daily experience of students (Treagust, Chittleborough & Mamiala, 2003). The submicroscopic aspect is also real

but invisible, consisting of particulate levels that can be used to explain the movement of electrons, molecules, particles or atoms (Davidowitz, Chittleborough, & Murray, 2010). The symbolic aspect consists of symbols and equations of chemical reactions used to communicate the concept of chemistry (Dori & Hameiri, 2003). Corradi et al., (2014) said symbols are essential for communicating chemical information.
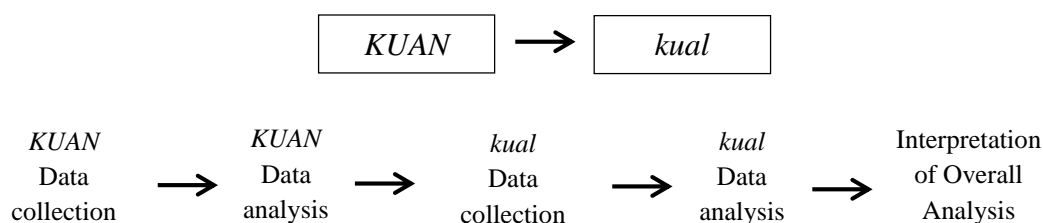
The material of the buffer solution is the material chemistry which is containing a complex concept including the macroscopic, submicroscopic, and symbolic aspects. This material makes students less trained to link macroscopic and symbolic knowledge with submicroscopic knowledge in buffer solution

material (Orgill & Sutherland, 2008). The material of the buffer solution was also very appropriate if studied by learning with the Chemoentrepreneurship approach. The production of many products in daily life that apply buffer solutions, e.g., citric acid is used to control the pH of the solution in the cleaning agent. Citric acid is also used as a natural preservative and a sour taste enhancer in foods and beverages.

The learning of buffer solution materials used in this study used multiple representation-Chemoentrepreneurship of teaching materials. This teaching material aimed to determine the extent of the influence of entrepreneur interest on student learning outcomes.

2. Methods

This research was conducted in state senior high school 12 (SMA Negeri 12) Semarang in the even semester of academic year 2017/2018. The research method is a mixed method with sequential explanatory strategy design. In general, the design of sequential explanatory strategy is presented in Fig. 1. The subjects consist of 3 classes from eleven grade of natural science class, namely class XI MIPA 3, XI MIPA 4, and XI MIPA 5.

KUAN → *kual*

| *KUAN* Data collection | → | *KUAN* Data analysis | → | *kual* Data collection | → | *kual* Data analysis | → | Interpretation of Overall Analysis |

Fig. 1. The Design of Sequential Explanatory Strategy(Creswell, 2010)

Quantitative data obtained from three-tier multiple choice test amounted to 20 items. Qualitative data were obtained from a questionnaire of teaching materials response and entrepreneur interest. The influence of entrepreneur interest on student learning outcomes has been determined by the linear regression test. Linear regression analysis is based on the functional and causal relationship of one dependent variable with one independent

variable (Sugiyono, 2010). Hypothesis test by using linear regression analysis with the assisted of SPSS 22.0 program.

3. Results and Discussion

Three validators have validated multiple representation-Chemoentrepreneurship of teaching materials. Validation results are shown in Table 1.

Table 1. Score Recapitulation of Material Feasibility Validation

No.	Rated Aspect	Validator Score			Average
		1	2	3	
1	Content Feasibility	79	78	94	83.667
2	Presentation Feasibility	43	46	48	45.667
3	Language Feasibility	43	36	48	42.333
4	Graph Feasibility	17	20	19	18.667
	Total				190.333
	Criteria				Very Feasible

Based on the results listed in Table 1, it can be concluded that the teaching materials of multiple representation.

Chemoentrepreneurships are appropriate for use in learning. This is reinforced by the result of student response questionnaire for teaching materials multiple representation.

Chemoentrepreneurship with the average score is 29.500 with good category and reliability equal to 0.871.

The material of buffer solution consists of several concepts, namely the definition and properties, component, working principle, pH, and role. The percentage of students' understanding on each concept of the buffer solution is presented in Table 2. Based on Table 2, it is known that the biggest concept understanding of student on pH concept in the buffer solution is 15.658%.

Table 2. Data of Understanding Profile on Each Concept of Buffer Solution

No.	Concept	Item Number	Percentage (%)
1	The Properties of Buffer Solution	1,2,3	7.763
2	Component	6,10,12,15	10.088
3	Work Principle	7,14,19	6.667
4	pH of Buffer Solution	4,5,9,11,16,17,18,20	15.658
5	Role of Buffer Solution	8,13	6.886
	Total		47.061

Learning activities using by learning material of multiple representation-Chemoentrepreneurship also examines the growing interest in student entrepreneurship that is seen through the questionnaire of entrepreneurship interest that is filled by 114 students. The results of the questionnaire analysis are presented in Figure 2.
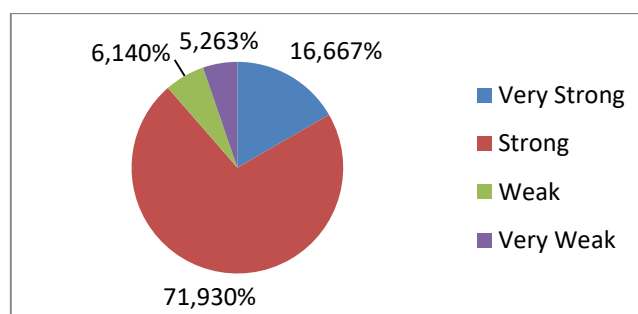
Figure. 2. Analysis Results of Student Entrepreneurship Interest

Based on Fig. 2, it can be concluded that as much as 88.597% of students have entrepreneur interest with strong criteria and very strong which means have reached a minimum of $\geq$ 70%. The result of strong entrepreneurship interest is a positive impact of the use of materials multiple representation-Chemoentrepreneurship in the learning process that is designed to behave in entrepreneurship and fun for students. The products produced by

students in this learning are shampoo, dishwashing soap, and soy milk.

The influence of entrepreneur interest on student learning outcomes was analyzed with SPSS 22.0 program with the result presented in Figure 3.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	51.262	2.452		20.904	.000
	X	.297	.028	.715	10.811	.000

a. Dependent Variable: Y

Fig. 3. Results of Entrepreneur Effect on Learning Outcomes by Linear Regression Analysis

Based on Fig. 3, it can be concluded that is t_{count} (10,811) > t_{table} (1,660) and significance value is <0,05 which means the interest of entrepreneur influence to student learning result. Results of SPSS analysis also stated that the coefficient of determination is 0.511 which means that the influence of entrepreneur interest on student learning outcomes of 51.1%.

The use of teaching materials of multiple representation-Chemoentrepreneurship in the learning process provides an opportunity for students to better understand the material of buffer solution using by learning the text better due to the teaching materials provides students with the opportunity to learn independently. Thus, the students can know the concept or information that exist and directly apply to the understanding test (Kusuma & Siadi, 2010).

4. Conclusion

Based on the result of the research, it can be concluded that (1) teaching materials of multiple representation-Chemo entrepreneur ships are very suitable for learning; (2) students give positive responses to teaching materials used in learning, and (3) entrepreneur interest influences on student learning outcomes of 51.1%.

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