The Effect of Model Variations on Chemistry Learning Outcomes

Isna Rezkia Lukman[1], Ratna Unaida[2], Sri Setiawaty[3], Najiha Sabrina[4], Zahara[5]

[1,2,3,4,5]Chemistry Education, Malikussaleh University, Indonesia
rezkia.lukman@unimal.ac.id

ABSTRACT

Keywords:

Learning Outcomes,
Chemistry,
Model Variation

One of the successes in the learning process can be seen from the learning outcomes of students. One of the factors that support this is external factors. External factors are factors that come from outside the learner, such as model variations. The purpose of this study was to determine whether there is an influence of model variations in chemistry learning on chemistry learning outcomes in Lhokseumawe City. This research used a quantitative approach, the type of research was *ex post facto*, and the research design was regression. The population in this study was all students who were in Grade XI Science Senior High School, while the sampling technique in this study was *cluster sampling*, the sample taken was several students at Senior high schoolsenior high school. Questionnaire was used for data collection instruments. The questionnaire was created based on a Likert scale with 4 answers already available. Data testing using a non-parametric hypothesis test, namely an SPSS-assisted *spearman rank correlation* test. Based on the hypothesis test, a significant value model variation is obtained from 0.028 < 0.05. It can be concluded that there was a significant influence between the variations of model in chemistry learning on the results of learning chemistry.

––––––––––– ◆ –––––––––––

A. INTRODUCTION

Education is the conscious ability to create a learning environment and learning process, so that students are enthusiastic about developing religion, self-control, personality, intelligence, and noble morals that students need for themselves, society, the state, and potential skills that affect themselves, society, nation, and state (Undang-Undang Republik Indonesia Nomor 20, 2003). The purpose of education is to facilitate learning and allow learners to acquire knowledge and develop skills. In addition, it can also improve the quality of life (Guo et al., 2019). Education in schools is basically organized through the teaching and learning process. The teaching and learning process involves the interaction between teachers and students to produce outputs, or learning outcomes (Hessal Alif et al., 2020). If the learning process goes correctly according to the rules, the learning outcomes are good. The achievement or success of self-study goals can be seen from the student's learning outcomes (Wijaya & Bukhori, 2017). One of the indicators of education is the learning outcomes achieved by students (Muliaman et al., 2018).

Learning outcomes are a benchmark that can be used to determine a student's academic achievement in mastering the subject matter. However each student who achieves a different level of learning outcomes, some students achieve high learning outcomes and others with low learning outcomes (Fauzi & Satrianto, 2020). Learning outcomes are influenced by factors such as learning motivation, interest in learning, family environment, and learning models (Lastri et al., 2020).

Learning outcome factors can be grouped into internal and external factors. Internal factors are factors that originate from within the learner, such as physiological and psychological factors. While external factors are factors that come from outside the learner, such as environmental factors and instrumental factors. Some external factors of instrumental factors are variations in learning models, learning media and infrastructure, which affect student learning outcomes (Purwanto, 2017). External factors can also be grouped into factors of the school environment, the home environment, and the community environment. School environmental factors are factors related to the way teachers teach in the classroom, the equipment used to teach in the classroom, the conditions of the school environment and matters related to the school environment (Marlina & Solehun, 2021).

The learning model is an external factor of learning outcomes. A learning model is a form of learning that is described by the teacher from beginning to end and presented distinctively by the teacher. In other words, a learning model is a framework that encompasses the application of learning approaches, methods, strategies, and techniques. Variations in the learning model are overall concept skills in how the material is delivered to students, so that students understand and remember the material presented so that good learning outcomes are obtained (Helmiati, 2012). Educators as facilitators are expected to be able to explore the potential of students to master the material with minimal abilities. The goal is to understand the concept of improving students' understanding (Lestari et al., 2018).

The learning model and process illustrate the importance of the activities that educators carry out during the learning process. A learning model is a set of learning activities that include strategies, methods, techniques, and learning media. Teachers or educators focus on specific attitudes when conducting learning activities (Adam, 2017). The variation in learning models have been developed to find effective and efficient ways to achieve learning objectives (Ratini et al., 2018).

Chemistry learning is often considered conceptually difficult for college students because of the language, symbols, and abstract properties that underlie many chemistry concepts. Students in the process of learning chemistry often acquire knowledge without understanding the underlying principles. Students assume that chemistry learning is difficult to maintain, transfer, or apply to real-world applications (Bokosmaty et al., 2019). In chemistry classes, abstract concepts become one of the causes of students having difficulty in guessing concepts or being able to guess concepts but not following actual concepts. Concepts that are not understood according to scientific concepts can last a long time and are difficult to improve through formal education because they can explain the problems faced (Lukman et al., 2022). Educators need to bring meaningful chemistry learning and make students interested in studying chemistry to compete in the global era (Rusmansyah et al., 2019).

According to interviews from several teachers at in senior high school in Lhokseumawe, each teacher teaches chemistry using a variety of learning models. This is because of the need and importance of using variations of models in chemistry learning so that students are not saturated in learning. In addition, teaching chemistry using a variety of models makes students also more enthusiastic and easier to understand chemistry materials.

Each teacher teaches has its own characteristics, one of which is the learning model used by the teacher when teaching, but not all students are familiar with the material presented by the teacher, especially chemistry lessons. There are learners who prefer a hands-on learning model, a problem-based learning model or a discussion model. Meanwhile, chemistry lesson in high school are designed to help students understand interrelated theories, principles, concepts, and

basic laws and apply these knowledge to everyday life. (Dewi et al., 2019). Therefore, a good learning model is needed so that students can properly build concepts that they need to understand (Nugraheni et al., 2022). So, the variety of learning models applied by teachers is one of the very important factors for students to obtain good learning outcomes, but in Lhokseumawe City there is no data on this matter. So, the purpose of this study is to determine the influence of variations in chemistry learning models on chemistry learning outcomes in Lhokseumawe City.

B. METHOD

This research used a quantitative research approach and ex post facto research types. Ex post facto research is conducted after an event in which the researcher wants to re-know what is the causative factor of the bound variable of the free variable (Darmadi, 2013). The research design used in this study was regression research. This study aimed to test whether there is an influence of model variations in chemistry learning on chemistry learning outcomes in Lhokseumawe City. The population in this study was all students who were in senior high school with a total of eight schools in four sub-districts. The sampling technique in this study was cluster sampling. So, the sample taken was students at senior high school, where one school represented one sub-district.

The data collection instrument in this study used a questionnaire made by the author. The questionnaire was made based on conceptual and operational definitions of model variations. The indicators of model variations were (1) general patterns of chemistry learning planning; (2) chemistry teaching and learning activities; and (3) achieving chemistry learning goals. Meanwhile, the criteria for model variations were planning variations models, planning situations and conditions, effective chemistry learning, implementing chemistry learning, understanding chemistry materials, and answering questions.

The questionnaire that was made has been validated by three expert lecturers in the field of chemistry education and Indonesian language and literature education, and a reliability test was carried out, with 20 respondents who were not included in the sample. The variable data of model variations were analyzed using average values and standard deviations based on excellent, good, poor, and bad category. The data were obtained through questionnaires from 413 samples. Based on the data, the total score was 17990. Then the average score obtained from the model variation was 43.56 as for the grouping of categories, as shown in Table 1.

Table 1. Descriptive Analysis Results By Category

No.	Score Range	Score Range	Category
1	$X \geq Yi+1.Sbx$	$X \geq 45$	Excellent
2	$Yi+1.Sbx > X \geq Yi$	$45 > X \geq 37,5$	Good
3	$Yi > X \geq Yi-1.Sbx$	$37,5 > X \geq 30$	Poor
4	$X < Yi-1.Sbx$	$X < 30$	Bad

This study used several classical assumption tests (prerequisite tests) namely normality tests, linearity tests, multi-collinearity tests, heteroscedasticity tests and autocorrelation tests. The classic assumption test was carried out with the help of SPSS. The hypothesis test on this study used a simple linear regression test with the help of SPSS. A simple linear regression test was based on a functional or causal relationship of one free variable with one bound variable. In this study, simple linear regression was used to find out how much influence between model variations in chemistry learning on chemistry learning outcomes (Sugiyono, 2016).

C. RESULTS AND DISCUSSION

The questionnaire of variations in learning models was arranged based on indicators, as for the indicators of variations in chemistry learning models, namely: (1) general pattern of chemistry lesson planning; (2) teaching and learning activities; and (3) achieving learning goals. The chemistry learning model variation questionnaire has been validated and tested for reliability with valid and reliable results. The results of the questionnaire for the variation of the model for high school respondents obtained an average score of 43.56. Based on Table 1, the model variation of respondents at senior high school was 45 > 43,56 ≥ 37,5 and belongs to good category. Meanwhile, according to the questionnaire indicators where each indicator has five statement results, as shown in Table 2.

Table 2. Results of analysis of model variation data descriptions of each indicator

No.	Indicator	Cryteria	Average Score	Score Range	Category
1	General patterns of chemistry lesson planning	Planning variations of chemistry learning models.	15,73	15,73 ≥ 15	Excellent
		Planning of the situation and conditions.			
2	Teaching and learning activities	Effective chemistry learning.	13,99	15 > 13,99 ≥ 12,5	Good
		Implementation of chemistry learning.			
3	Achieving learning goals.	Understanding of chemical matter.	13,85	15 > 13,85 ≥ 12,5	Good
		Answering questions			
	Total Score		43,57		

Based on table 2, the results were obtained that the first indicator, namely the general pattern of chemistry lesson planning, has a score range 15,73 ≥ 15, then it belongs to the category of very good. The second indicator was that teaching and learning activities have a score range of 15 > 13,99 ≥ 12,5, then it belongs to the good category. While the last indicator, namely achieving learning goals, has a score range 15 > 13,85 ≥ 12,5, then it belongs to the category of good. Based on figure 1, it was found that the students who answered the questionnaire of model variations in the "excellent" category were 42%, 53% in the "good" category, 5% in the "poor" category, and 0% in the "bad" category.

The results of the classical assumption test, namely the normality test, obtained the *Asymptotic Sig* value on *Kolmogorov Smirnov*, the learning model variation variable was 0.000, then the significant value was 0.000 less than 0.05. So, the results were obtained that this research variable was not distributed normally, because the value of the significant number (Sig) was smaller than 0,05. The low normality value in this study was caused by variations in the values obtained, causing the data not to be distributed normally.

Hypothesis tests are used in a non-parametric form, because the data did not meet the classical assumption test that was, the data was abnormal. So, the non-parametric hypothesis test used was the spearman rank correlation test. The spearman rank correlation test was used to determine the significant strength of the relationship between the variables X and Y. The spearman rank correlation was used for variables that are not normally distributed. The Spearman rank correlation test was performed with the help of SPSS (Roflin & Zulvia, 2021). The results of hypothesis testing were obtained, as shown in Table 3.

Table 3. Spearman Rank Correlation Test the Effect of Model Variations on Learning Outcomes

Correlations

			Variasi Model	Learning Outcomes
Spearman's rho	Variasi Model	Correlation Coefficient	1.000	.108*
		Sig. (2-tailed)	.	.028
		N	413	413
	Learning Outcomes	Correlation Coefficient	.108*	1.000
		Sig. (2-tailed)	.028	.
		N	413	413
*. Correlation is significant at the 0.05 level (2-tailed).				

Based on the spearman rank correlation, significant value results of model variations were obtained 0,028 < 0,05. It can be concluded that the variable variation of the model affects learning outcomes, because the significant value (Sig) < 0.05. The results of this study show that model variations have a significant influence on chemistry learning outcomes. This means that the results of learning chemistry will be better if chemistry lessons use a variety of models.

The variety of models in chemistry learning has a significant influence on the results of learning chemistry at senior high school. This is supported by research by Damayanti & Jirana (2018) which states that there is an influence of learning models on the learning outcomes of students of class XI IPA. In line with that, according to Priansa (2019) the learning model is a concept that describes procedures in a structured and planned manner in organizing the learning process of students so that learning objectives can be achieved effectively.

The results of a study using the cluster sampling technique at senior high school showed that there was a significant influence of model variations on chemistry learning outcomes. Many students of senior high school in agreed to use variations of models in chemistry learning. The school uses several learning models that are applied by chemistry teachers during the chemistry learning process. There are several learning models that are often applied by teachers in class XI public high schools in the city of Lhokseumawe, namely direct learning models, discovery learning, problem based learning, cooperative learning, and inquiry. The school used several learning models that applied during the chemistry learning process. Some of the learning models applied by teachers at senior high school were direct learning models, discovery learning, problem-based learning, cooperative learning, and inquiry.

D. CONCLUSION AND SUGGESTION

Based on the results of data analysis and discussions that have been presented previously, it can be concluded that there is a significant influence of model variations in chemistry learning on chemistry learning outcomes in Lhokseumawe City. This can be seen from the significant value smaller than 0.05. The significant value is 0.028 < 0.05. The results of this study indicate that the variation of the model has a significant effect on the results of learning chemistry. Chemistry learning outcomes will be better if chemistry lessons use a variety of models. The author's suggestion is that teachers should apply variations of models in chemistry learning in Lhokseumawe City so that student chemistry learning outcomes will improve. In addition, researchers can then add other variables, samples, or populations.

ACKNOWLEDGMENT

REFERENCES

Adam, F. F. (2017). Pengaruh Model Pembelajaran Dan Motivasi Belajar Terhadap Hasil Belajar Kognitif Peserta Didik Kelas Xi Ipa Madrasah Aliyah Syekh Yusuf Sungguminasa (Studi Pada Materi Larutan Asam Dan Basa). *Chemistry Education Review (CER)*, *0*(0)volume? issue?, 73–83. https://doi.org/10.26858/CER.V0I0.3881

Bokosmaty, R., Bridgeman, A., & Muir, M. (2019). Using a Partially Flipped Learning Model To Teach First Year Undergraduate Chemistry. *Journal of Chemical Education*, *96*(4), 629–639. https://doi.org/10.1021/ACS.JCHEMED.8B00414

Damayanti, M., & Jirana. (2018). Pengaruh Model Pembelajaran dan Minat Belajar terhadap Hasil Belajar Kimia Peserta Didik Kelas XI IPA SMAN 1 Tinambung. *Saintifik*, *4*(1), 47–53.

Darmadi, H. (2013). *Dimensi-dimensi Metode Penelitian Penddikan dan Sosial Konsep Dasar dan Implementasi*. Alfabeta.

Dewi, R. K., Wardani, S., Wijayati, N., & Sumarni, W. (2019). Demand of ICT-based chemistry learning media in the disruptive era. *International Journal of Evaluation and Research in Education (IJERE)*, *8*(2), 265–270. https://doi.org/10.11591/IJERE.V8I2.17107

Fauzi, A., & Satrianto, A. (2020). *The Effect of Parents' Social Economic Condition, Way of Learning and Learning Motivation to the Learning Outcome of Economy Subject*. *152*,issue? 413–421. https://doi.org/10.2991/AEBMR.K.201126.046

Guo, L., Huang, J., & Zhang, Y. (2019). Education Development in China: Education Return, Quality, and Equity. *Sustainability (Switzerland)*, *11*(13), 1–20. https://doi.org/10.3390/SU11133750

Helmiati. (2012). *Model Pembelajaran*. Aswaja Pressindo.

Hessal Alif, M., Pujiati, A., Yulianto, A., Negeri, S., Jl Raksa Wijaya, I., & Sembung Wetan, K. (2020). The Effect of Teacher Competence, Learning Facilities, and Learning Readiness on Students' Learning Achievement Through Learning Motivation of Grade 11 Accounting Lesson in Brebes Regensy Vocational High School. *Journal of Economic Education*, *9*(2), 150–160. https://doi.org/10.15294/JEEC.V9I2.40155

Lastri, L., Kartikowati, S., & Sumarno, S. (2020). Analysis of Factors that Influence Student Learning Achievement. *Journal of Educational Sciences*, *4*(3), 679–693. https://doi.org/10.31258/JES.4.3.P.679-693

Lestari, P., Wardani, S., & Sumarti, S. S. (2018). Influence of Guided Inquiry Model on Students Cognitive Learning Outcome in Stoichiometrytopic. *Journal of Innovative Science Education*, *7*(2), 130–135. https://doi.org/10.15294/JISE.V7I2.23853

Lukman, I. R., Unaida, R., & Fakhrah, F. (2022). Developing of Four-Tier Diganostic Test to Identify Test Profile on Acid and Base Materials. *IJECA (International Journal of Education and Curriculum Application)*, *5*(1), 7–16. https://doi.org/10.31764/IJECA.V5I1.6359

Marlina, L., & Solehun. (2021). Analisis Faktor-Faktor yang mempengaruhi Hasil Belajar Bahasa Indonesia pada Siswa Kelas IV SD Muhammadiyah Majaran Kabupaten Sorong. *Jurnal Keilmuan, Bahasa, Sastra, Dan Pengajarannya*, *2*(1), 66–74. https://unimuda.e-journal.id/jurnalbahasaindonesia/article/download/952/582

Muliaman, A., Suyanti, R. D., & Eddiyanto, D. (2018). Relationship between Motivation and College Students Learning Outcomes on Chemical Kinetic Material at University. *Atlantis Press*, *200*, 26–28. https://doi.org/10.2991/AISTEEL-18.2018.6

Nugraheni, P. W., Joharmawan, R., & Utomo, Y. (2022). Collaborative Guided Inquiry for Chemistry

Learning Outcomes Improvement on Solubility Product Concept. *PSEJ (Pancasakti Science Education Journal)*, *7*(1), 31–40. https://doi.org/10.24905/PSEJ.V7I1.134

Priansa, D. J. (2019). *Pengembangan Strategi dan Model Pembelajaran*. Pustaka Setia.

Purwanto, M. N. (2017). *Psikologi Pendidikan*. Remaja Rosdakarya.

Ratini, Muchtar, H., Suparman, M. A., Tamuri, A. H., & Susanto, E. (2018). The Influence of Learning Models and Learning Reliance on Students' Scientific Literacy. *Jurnal Pendidikan IPA Indonesia*, *7*(4), 458–466. https://doi.org/10.15294/JPII.V7I4.12489

Roflin, E., & Zulvia, F. E. (2021). *Kupas Tuntas Analisis Korelasi* (M. Nasrudin (ed.)). Nasya Expanding Management.

Rusmansyah, Yuanita, L., Ibrahim, M., Isnawati, & Prahani, B. K. (2019). Innovative Chemistry Learning Model: Improving the Critical Thinking Skill and Self-Efficacy of Pre-Service Chemistry Teachers. *Journal of Technology and Science Education*, *9*(1), 59–76. https://doi.org/10.3926/JOTSE.555

Sugiyono. (2016). *Statistika untuk Penelitian*. Alfabeta.

Undang-Undang Republik Indonesia. (2003). *Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional*.

Wijaya, O. P., & Bukhori, I. (2017). Effect of Learning Motivation, Family Factor, School Factor, and Community Factor on Student Learning Outcomes on Productive Subjects. *JPBM (Jurnal Pendidikan Bisnis Dan Manajemen)*, *3*(3), 192–202. https://doi.org/10.17977/UM003V3I32017P192