Research Article

The effect of the application of the think talk write model and self-efficacy on students' critical thinking ability in the material reaction rate in SMA Adhyaksa 1 Jambi city

Intan Aulia Sari[1], Haryanto[2] and Yusnaidar[2]

1 *Chemistry Education, Magister Program, Faculty of Education and Teacher Training, Jambi University, Jambi 36361, Indonesia*

2 *Department of Chemistry Education, Jambi University, Jambi 36361, Indonesia*

Corresponding author: Intan Aulia Sari (intanaulia8899@gmail.com)

Abstract

The ability to think critically is very important to support the progress of education. In developing good mastery of learning concepts, students' critical thinking skills are needed. The development of critical thinking skills can make students give up, so it takes a firm belief in students' abilities in overcoming difficulties so they can become more advanced. This study aims to see the effect of the Think Talk Write (TTW) and Self Efficacy on students' critical thinking skills in the matter of reaction rate. The sample used consisted of 2 classes at SMA Adhyaksa 1 Jambi City. The data collection instruments used were observation sheets, self-efficacy, and essay tests. The data analysis used was 2-way ANOVA. The results showed that learning using the TTW and Self Efficacy affected students' critical thinking skills with an average of 71% from meeting 1, meeting 2, and meeting 3. Then there is an interaction between the Think Talk Write and Self Efficacy on students' critical thinking skills seen from a significance value of 0.000 <0.05.

Introduction

Developing the concept of mathematical critical thinking is one way to train students to think in learning, including learning chemistry. According to (Fisher, 2009) critical thinking aims to teach the ability to interpret, analyze, and evaluate ideas and arguments. In developing good mastery of learning concepts, students' critical thinking skills are needed, when students work on a given problem they tend to need analytical power and think logically, this is in line with (Nurjaman and Sari, 2017), critical thinking is the basis of thinking processes to analyze arguments and bring up ideas for each meaning to develop a logical mindset. Critical thinking in students can not only be seen from the ability of students to answer or solve problems, but also can be seen from the ability and quality of questions asked by students (Siahaan et al. 2021). According to (Fattahi and Haghverdi, 2015) Critical thinking is the ability to think rationally, and logically. Critical thinking is an active thinking process that involves studying, observing, and analyzing a problem to conclude. A person who has professional critical thinking skills will ask important and critical questions to explore possible solutions, collect concrete and abstract ideas from various sources, conclude a logical relationship between differences of opinion, and solve problems through the systematic collection of information. Several researchers have suggested different skills for the development of critical thinking. These skills are analyzing, applying standards, seeking information, discriminating, thinking logically, predicting, and transforming knowledge. Sumarmo et al. (2012) define critical thinking as reflective thinking that is reasoned and focused on determining what to believe or do. This aims to increase the potential of students and can develop optimally. In addition, confident in their abilities, systematic and open to the development of science. To achieve critical thinking skills, especially in chemistry learning, students need adequate behavior, one of which is self-efficacy.

According to (Ouyang et al. 2020) to be more specific, individuals usually come from different social structures, and feelings of self-acceptance or self-satisfaction can come from their ability to follow socially determined norms and interpret social roles. Thus, self-efficacy comes from their experiences. According to (Bandura, 1997), self-efficacy is a belief that individuals have in their ability to take actions that can affect their lives. Self-efficacy in learning is how self-efficacy exists in students when learning, namely how students are prepared in learning, students' courage in acting while studying, students' self-confidence in learning, and how students motivate themselves so they can master the learning process so that it will improve student learning outcomes. Students who have self-efficacy have confidence in themselves that they can do something or overcome a situation that they will succeed in doing so, whereas students with self-efficacy feel a lack of self-confidence and are unable to overcome the problems they will face. According to van-Dinther et al. (2011), self-efficacy can also be used to predict previous learning behavior and learning capacity in acquiring new skills. Aldholay et al. (2018), divided self-efficacy into four aspects, namely belief in facing uncertain situations, belief in the ability to drive motivation, belief in achieving predetermined targets, and belief in the ability to overcome problems that arise.

One of the chemistry materials that require students to improve their critical thinking skills is the reaction rate material. This material is taught in class XI (eleven) odd semester. The characteristic subject matter of this complex reaction rate is one of the causes of student learning difficulties. The rate of reaction has several main materials that must be taught, namely; collision theory, the determinants of the rate of reaction, the order of the reaction and the rate equation of the reaction. Based on this subject matter, there are basic competencies that must be mastered by students, namely understanding collision theory to explain chemical reactions, analyzing the factors that affect the reaction rate and determining the order of the reaction based on experimental data. Therefore students must be able to think at a higher level so that students can understand the concepts of the material being studied.

Learning on the reaction rate material at Adhyaksa 1 High School Jambi City, information was obtained that students were still rote so that the students' conceptual understanding was quite low and had an impact on students' critical thinking skills. The learning model that has been used by teachers is the student teams achievement division (STAD) cooperative learning model. However, the application of the STAD model by the teacher has not been able to improve students' critical thinking skills (Silaban et al. 2022). Because in the learning process using the STAD model, the aspects of activities carried out by students are more in groups so that many students depend on smart students without actively participating in groups. This was proven when the explanation of the sample questions was asked for the value of the reaction rate (v) and when the exercise was asked for the value of the reaction rate (v), students could answer the question, but in the explanation of the example questions they were asked for the value of the reaction rate (v) and during practice If the question is asked for the price of the reaction rate constant (k), the student will be confused and in the end the student cannot answer the question. Students also experience difficulties in analyzing questions from the factors that affect the reaction rate and its relation to collision theory.

An alternative that can be applied to overcome this problem is to apply the Think Talk Write (TTW) cooperative learning model. TTW strategy was introduced by Huinker and Laughlin (Hasibuan et al. 2018), where the learning process occurs through thinking, speaking and writing. This strategy starts with students reading to understand a problem, then followed by thinking about a solution (Think), then students communicate their solution (Speaking) then through discussion and exchange of opinions students write down the results of their thoughts (Write). The TTW strategy directs students to work in groups of 4-5 students for each group.

The TTW strategy steps are Think, Talk, and Write. In the thinking step, students and their groups think individually to determine ideas to answer problems. Then in the second step, namely speaking, students discuss with their groups to share ideas about solving the problem. The third step is writing, students begin to write solutions to these problems according to what they get in the group. The advantage of implementing learning using the TTW learning model is that students are trained to be actively involved in the learning process, and in this learning the teacher emphasizes individual and group learning so that students' understanding of the concepts being studied becomes better and can improve students' critical thinking skills (Chatarina, 2004). The other advantages of the TTW model according to Shoimin (2014), are: (1) developing meaningful solutions in understanding teaching materials; (2) by providing open ended can develop students' critical and creative thinking skills; (3) by interacting and discussing with groups, students will be actively involved in learning; and (4) familiarize students to think and communicate with friends, teachers, even with themselves.

Based on the results of the test analysis conducted by Muhsin et al. (2019) who applied the TTW model to learning colloidal chemistry material obtained an average activity result that was better and positive on student learning outcomes when compared to the conventional model. This is in line with research conducted by Sogandi et al. (2019), which states that through the TTW learning strategy given in 3 face-to-face meetings, students can absorb the material well and can improve student learning outcomes. Research conducted by

(Yanuarta et al. 2016), which shows that the TTW model combined with PBL can empower critical thinking skills, so that students can achieve a deeper understanding of concepts and will later improve students' cognitive learning outcomes. Research conducted by Hari et al. (2018), explained that students who have self-efficacy will tend to be more critical, have lots of ideas and are more courageous in making decisions to solve existing problems and can provide explanations of what has been proven.

Method

Population and sample

The population in this study were students of class XI IPA SMA Adhyaksa 1, Jambi City, which consisted of three classes. Class XI IPA 1 has 28 students, XI IPA 2 has 28 students, and class IPA 3 has 31 students. Sampling used the Simple random sampling technique and obtained a sample of IPA 1 class as the control class and IPA 2 class as the experimental class.

General procedure

This study used a factorial design 2 x 2, to confirm the results of hypothesis testing is done with a mixed method where the learning process with the TTW model is carried out concurrent triangulation to ascertain which learning stages contribute to learning outcomes. Furthermore, learning outcomes are also carried out concurrent triangulation to determine the impact on the sustainability of student learning skills. This research experiment took into account the possibility of a moderator variable influencing the treatment (independent variable) on the outcome (dependent variable). The experimental design that was carried out in this study is shown in Fig. 1.
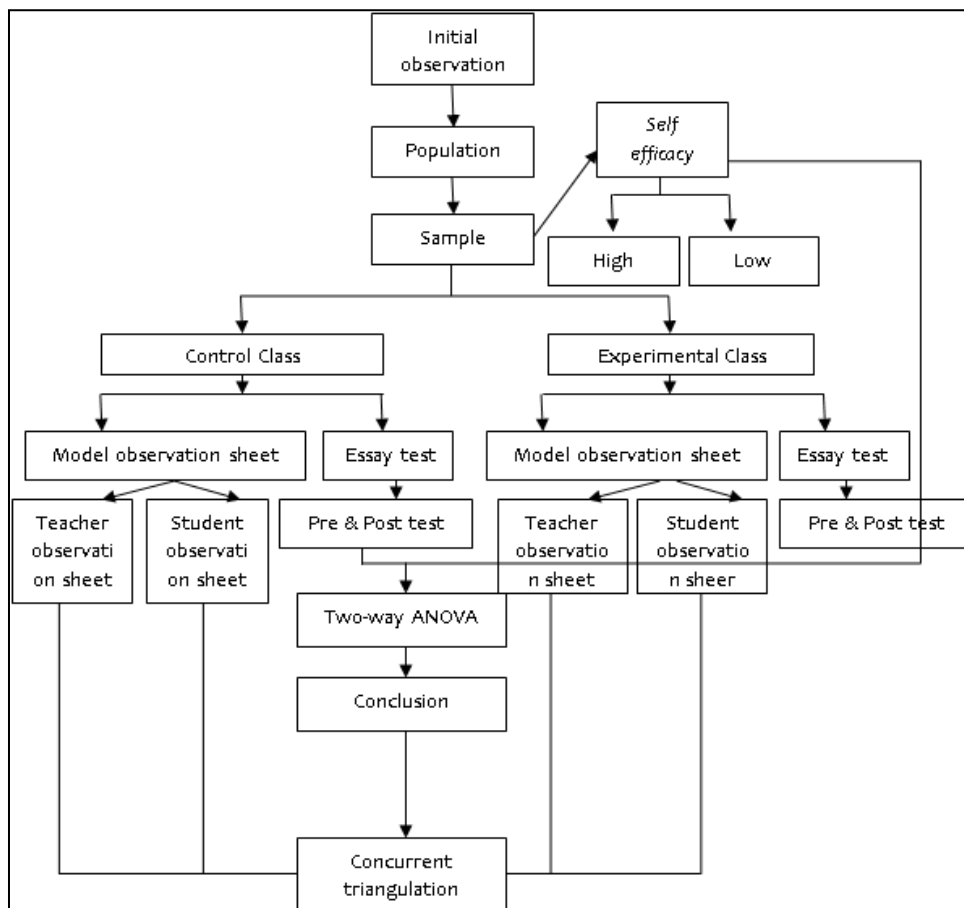

Figure 1. Research design

Data analysis

Data analysis techniques used in this study are qualitative and quantitative data. Qualitative data in this study were obtained from observation sheets on the implementation of the TTW & STAD models by teachers, while quantitative data were obtained from observation sheets on the implementation of the TTW & STAD models by students, essay, and self-efficacy. Questionnaire Self Efficacy used is the result of the development of

(Hairida, 2017) which consists of 38 statements and has been validated by experts. After completing the Self Efficacy, students' scores were first analyzed using the following formula (Arikunto, 2014):

$$\text{Percentage} = \frac{\text{Total score achieved}}{\text{Maximum score}} \times 100\%$$

After obtaining the Self Efficacy each student, high and low criteria were determined. This criterion can be determined by the following formula:

$$\text{Range of values} = \frac{\text{Highest} - \text{lowest score}}{\text{Assessment category}}$$

Observation sheet model TTW by the teacher carried out qualitative data analysis techniques, namely in the form of comments by observers obtained from the model observation sheet TTW learning by the teacher and analyzed in detail from each statement item. If negative comments are obtained, then a discussion is held again with the observer guided by the video recording of the teacher's teaching activities. If it turns out that the comments are still negative, then the teacher asks for suggestions for improvements regarding teaching activities for the next meeting.

The observation sheet for the TTW model was carried out by students using quantitative data analysis techniques by calculating the score obtained from the observation sheet which contained 16 statement items. After obtaining the value of student activity based on the assessment category, then the average implementation of the TTW model by students is sought.

Test essay will be analyzed using an assessment rubric where the essay contains 5 questions for each meeting that cover aspects of critical thinking skills namely, providing simple explanations (elementary clarification), building basic skills (basic support), concluding (inference), making further explanations (advanced clarification), and set strategy and tactics (strategy and tactics). Scoring criteria for student essay in Table 1.

Table 1. Test questions essay (modified from Widoyoko, 2018)

Score	Score	% Critical Thinking Ability	Category
4	> 16.28	> 81.35	Very good
3	12.52 – 16.27	62.60 – 81.35	Good
2	8.76 – 12.51	43.80 – 62.55	Fairly good
1	5 – 8.75	25 – 43.75	Not Good

Results and Discussion

From the results of the self-efficacy which were categorized into two categories, namely low high self-efficacy and self, in the questionnaire there were 38 statements given to students before the start of learning. In the control class, 15 students had Self-Efficacy and 11 people who were high, while in the experimental class, there were 16 students who had Self-efficacy and 10 people who were high.

The implementation of the learning model by the teacher is qualitative data, observed using an observation sheet. It consists of 2 classes, namely the experimental class using the TTW model and the control class using the STAD model. In the learning process, the act of teaching by the teacher is observed by one observer. Based on the written test answers and observation sheets, the overall achievement of critical thinking indicators in the experimental class was higher than the control class. This is because in learning using the TTW students are trained to be actively involved in the learning process, in this model the teacher emphasizes individual and group learning. Meanwhile, in the STAD model, there are more activities carried out by students in groups so that many students depend on smart students only. With the TTW, in addition to increasing the sense of responsibility and cooperation, students can also increase their individual activity. This is in line with the research conducted by Wahyuni & Efuansyah (2018), that the TTW model can improve students' critical thinking skills because learning with the TTW model can direct students to construct their understanding and reasoning as well as demonstrate, communicate that reasoning to others according to theory. learn constructivism. This is also confirmed by (Ariani, 2017) the TTW learning model can encourage and stimulate students to always actively participate, then be communicative, able to express their own opinions objectively, try to respect the opinions of others and train students to write down the results of their discussions in written form systematically. so it's easier to understand.

Judging from the TTW, the syntax that has the greatest contribution is talk by 23%. This is because in talk learning is done in groups, students who do not understand the material and problems that have been observed in the think will be more flexible in discussing (talk) and exchanging ideas with their group mates so that students who do not understand will understand. This is in line with research conducted by Bustami et al.

(2019) which states that the talk will encourage students to express their opinions or arguments, this stage requires students to communicate in words and language that they understand in their groups to convey the results of their thoughts which have been carried out at the thinking stage which can process students' thoughts so that able to improve students' critical thinking skills. As for the lowest contribution, namely the write, which is equal to 18%. It is proven in this syntax, students still have difficulty in pouring the results of their discussions in written form and tend to follow their friends' sentences. This aspect is the most difficult aspect because students have to remember and write down the results of the discussion on the previous aspect.

Based on the data from the pre-test and post-test students' critical thinking skills can be seen in Fig. 2 and Fig. 3. The results obtained by students at the first meeting, the initial test was 18%, the post test was 60%; second meeting, initial test 25%, post-test 77%; third meeting, initial test 21%, post-test 76%. From the three meetings it can be seen that there was an increase when given treatment with the Think Talk Write with an overall average score of 21% for the initial test and 71% for the post test. As for the pre-test and post-test of students' critical thinking skills with the application of the STAD model, scores were obtained at the first meeting, the initial test was 19%, the post test was 54%; second meeting; initial test 25%, post-test 65%; third meeting, initial test 22%, post-test 62%. From the three meetings, the average score of the initial test was 22% and the post test was 60%. There are differences between the Think Talk Write model and the STAD model, so it can be concluded that the Think Talk write is more influential in improving critical thinking skills than the STAD model.
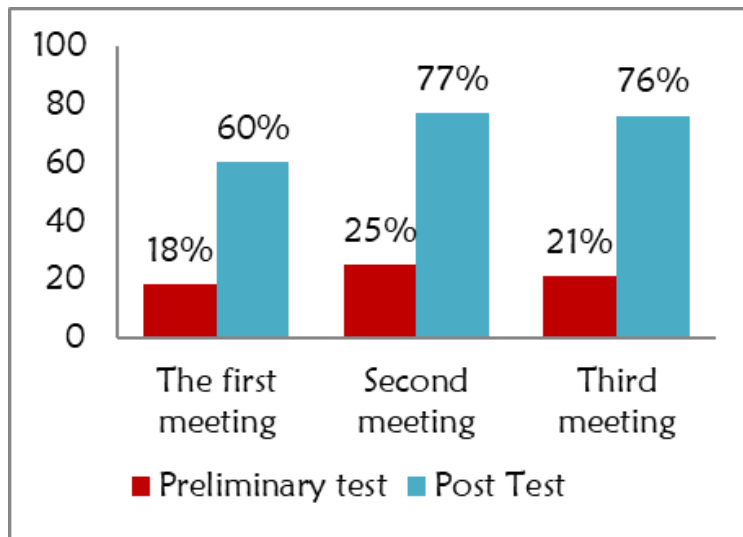

Figure 2. Diagram of the preliminary test and post-test learning average of the TTW model from the result obtained
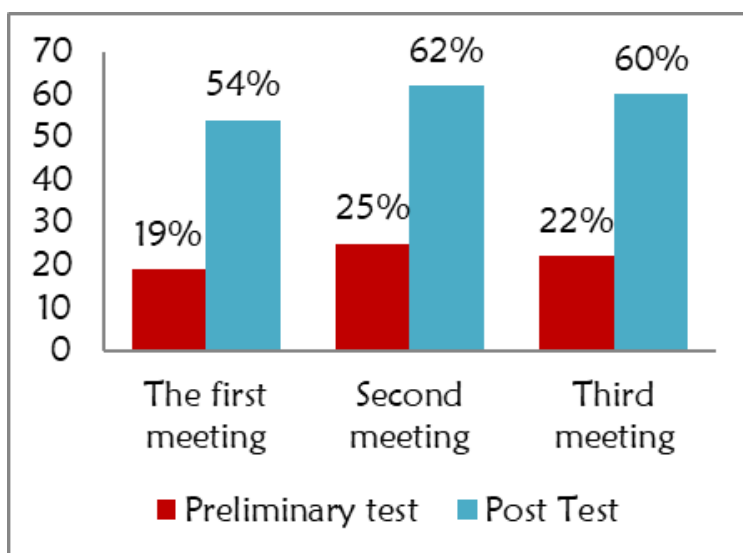

Figure 3. Diagram of the preliminary test and post-test learning average of the STAD model from the result obtained

Prior to the ANOVA test, the two sample lines must be tested for normality and homogeneity as a condition for ANOVA testing. Based on the test, the results obtained for Science class 1 had a significance value of 0.157> 0.05 and in Science class 2 the significance value was 0.145> 0.05, and in the homogeneity test the significance value was obtained 0.599> 0.005. This means that the sample has a significance value of >0.05, so it can be concluded that the sample is normally distributed and homogeneous.

From Table 2, the result is that to see the effect of self-efficacy on critical thinking skills, it can be seen from the significance value <0.05, it can be concluded that H0 accepted. This means that there is an influence of self-efficacy on critical thinking skills. The interaction graph between the TTW and Self efficacy on critical thinking skills is shown in Fig. 4.

Table 2. Two-lane anova test results

Dependent Variable: Post Test					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7720.988[a]	3	2573.663	152.053	.000
Intercept	238045.409	1	238045.409	14063.778	.000
Model	2945.156	1	2945.156	.000	SE
	1944.632	1	174.000	114.889	.000	Model
* SE	311.809	1 1944.632	311.809	18.422	.000
Error	812.455	48	16.926		
Total	284329.000	52			
Corrected Total	8533.442	51			

a. R Squared = .905 (Adjusted R Squared = .899)

Figure 4. TTW model interaction graph and self efficacy critical thinking ability

Second, to see the effect of the Think Talk Write on critical thinking skills and the significance value obtained is <0.05, which means that there is an influence of the Think Talk Write on students' critical thinking skills. Third, namely to see whether there is an interaction between the Think Talk Write and Self efficacy on critical thinking skills, the significance value obtained is also <0.05 and from Fig. 4. Information can be obtained that the longer the line pattern, the longer it will intersect, meaning that it indicates that there is interaction from the Think Talk Write and Self efficacy towards critical thinking (Rusdi, 2020).

Based on the research that has been done, it has been found that when given a task or problem to solve, it appears that students who have self-efficacy in both the control class and the experimental class have high enthusiasm in completing the task or problem. Students with self-efficacy show confidence in themselves to be able to complete assignments and face difficulties. They are confident in their abilities and have motivation within themselves to try their best to be able to do the tasks given and complete them and be the best. In line with Bandura (1997) said that individuals who have self -efficacy tend to do certain tasks, even though these tasks are difficult. Students do not see the task as something that needs to be avoided. According to Cheung (2015), self-efficacy is the main determinant of whether or not students want to try to do their assignments and continue to try to solve the problems given. One's consideration for organizing and performing the new actions needed to achieve the desired achievement is termed self-efficacy.

Students with self-efficacy are students who lack confidence and willingness to solve problems, tend to be silent and easily give up. It was proven during the learning process in both the experimental class and the control class that students with self-efficacy tended to be silent and did not dare to express their opinions, relying on other students to work in groups so that during the post test students with low self-efficacy levels had low scores. This is due to the lack of confidence, readiness, self-confidence, and students' desire to learn. In line with the research conducted by Isnadini and Rasmawan, (2014), students with According to research conducted by Skaalvik et al. (2015) stated that the relationship between student scores and motivation is partly mediated by emotional support and self-efficacy. Self efficacy will tend to give up when completing a difficult task, because they assume that they will not be able to complete it, thus making their motivation low and resulting in student academic achievement.

Conclusion

Based on the results of the study it can be concluded that there is an influence of the TTW model on students' critical thinking skills in the reaction rate material, there is a Self-Efficacy effect on students' critical thinking skills in the reaction rate material and there is an interaction between the TTW and Self Efficacy on thinking skills critical students on the material reaction rate.

Acknowledgment

References

Aldholay, A., Isaac, O., Abdullah, Z., Abdulsalam, R., & Al-Shibami, A. H. (2018). An extension of Delone and McLean IS success model with self-efficacy. *The International Journal of Information and Learning Technology*, 35(4), 285–304. https://doi.org/10.1108/ijilt-11-2017-0116

Ariani, D. N. (2018). Strategi peningkatan kemampuan komunikasi matematis siswa SD/MI. *Muallimuna: Jurnal Madrasah Ibtidaiyah*, 3(1), 96-107. http://dx.doi.org/10.31602/muallimuna.v3i1.958

Arikunto. (2014). Prosedur penelitian suatu pendekatan praktis. Jakarta: Rineka Cipta.

Bandura, A. (1997). Self-efficacy, the exercise of control. New York: W.H, Freeman and Company.

Bustami, Y., Riyati, Y., & Education, B. (2019). Think talk write with pictured cards on human digestive system: impact of critical thinking skills. *Jurnal Pendidikan Biologi*, 12(1), 13–23. https://doi.org/10.21009/biosferjpb.v12n1.13-23

Chatarina. (2004). Model-model pembelajaran efektif. Semarang : UPT UNNES

Cheung, D. (2015). The combined effects of classroom teaching and learning strategy use on students' chemistry self-efficacy. *Research Science Education*, 45, 101–116. https://doi.org/10.1007/s11165-014-9415-0

Fattahi, F., & Haghverdi, H. (2015). Does inquiry based learning enhance student's critical thinking: A case study of Iranian EFL learners. *International Journal Language Learning and Applied Linguistic World.*, 9(3), 134–141.

Fisher, A. (2009). Berpikir kritis: Sebuah pengantar. Jakarta: Erlangga.

Hairida, H. (2017). Pengembangan instrumen untuk mengukur self efficacy siswa dalam pembelajaran kimia. *Edusains*, 9(1). https://doi.org/10.15408/es.v9i1.4000

Hari, L. V., Zanthy, L. S., & Hendriana, H. (2018). Pengaruh self efficacy terhadap berpikir kritis matematik siswa SMP. *Jurnal Pembelajaran Matematika Inovatif*, 1(3), 435–444. https://doi.org/10.22460/jpmi.v1i3.435-444

Hasibuan, S. F., Dirgeyasa, I. W., & Murni, S. M. (2018). Improving students' achievement in writing narrative text through application of think talk write strategy. *Advances in Social Science, Education and Humanities Research*, 200, 539–542. https://doi.org/10.2991/aisteel-18.2018.116

Isnadini, W., & Rasmawan, R. (2014). Pemberian corrective feedback disertai reward terhadap efikasi diri dan hasil belajar kimia di sma. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 3(8), 1-12. http://dx.doi.org/10.26418/jppk.v3i8.6754

Muhsin, L. B., Sukib, & Laksmiwati, D. (2019). Pengaruh model pembelajaran think talk write (TTW) berpikir bicara menulis terhadap hasil belajar siswa pada mata pelajaran kimia materi koloid. *Chemistry Education Pratice*, 2(2), 37–43. https://doi.org/10.29303/cep.v2i2.1373

Nurjaman, A., & Sari, I. P. (2017). The effect of problem posing approach towards students' mathematical disposition, critical & creative thinking ability based on school level. *Infinity Journal*, 6(1), 69-76. https://doi.org/10.22460/infinity.v6i1.223

Ouyang, Y., Wang, K., Zhang, T., Peng, L., Song, G., & Luo, J. (2020). The influence of sports participation on body image, self-efficacy, and self-esteem in college students. *Frontiers in Psychology*, 10, 3039. https://doi.org/10.3389/fpsyg.2019.03039

Rusdi, M. (2020). Educational Treatment-Based Research. Depok: PT RajaGrafindo Persada.

Shoimin, A. (2014). Dasar-dasar evaluasi pendidikan (edisi revisi). Jakarta: Bumi Aksara.

Siahaan, R., Sitorus, M., & Silaban, S. (2021). The development of teaching materials oriented to critical thinking skills for chemistry class XI high school. *Jurnal Pendidikan Kimia*, 13(1), 60-68. https://doi.org/10.24114/jpkim.v13i1.24145

Silaban, M. S., Nisa, S. A., Silaban, S., & Sianturi, J. (2022). The development of sets-based chemic media on hydrocarbon material. *Jurnal Pendidikan Kimia*, 14(2), 85-96. https://doi.org/10.24114/jpkim.v14i2.32911

Skaalvik, E. M. Federici, R. A & Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. *International Journal of Educational Research*, 72, 129–136. https://doi.org/10.1016/j.ijer.2015.06.008

Sogandi, S., Iriani, R., & Irhasyuarna, Y. (2019). Penggunaan LKS dalam strategi pembelajaran TTW (think talk write) terhadap hasil belajar siswa pada materi reaksi redoks. *Quantum: Jurnal Inovasi Pendidikan Sains*, 10(2), 93. https://doi.org/10.20527/quantum.v10i2.5850

Sumarmo, U., Hidayat, W., Zukarnaen, R., Hamidah, H., & Sariningsih, R. (2012). Kemampuan dan disposisi berpikir logis, kritis, dan kreatif matematik. *Jurnal Pengajaran MIPA*, 17(1) 17–33. https://doi.org/10.18269/jpmipa.v17i1.36048.g15430

van Dinther, M., Dochy, F., & Segers, M. (2011). Factors affecting students' self-efficacy in higher education. Educational Research Review, 6(2), 95–108. https://doi.org/10.1016/j.edurev.2010.10.003

Widoyoko, E. (2018). Teknik penyusunan instrumen penelitian. Yogyakarta: Pustaka Pelajar.

Yanuarta, L., Gofur, A., & Indriwati, S. E. (2016). Empowerment of students critical thinking skills through implementation of think talk write combined problem based learning. *Proceeding Biology Education Conference*, 13(1), 268–271.