

*Eternal: English Teaching Journal*

Vol. 14, No. 1, pp. 35-46, Februari 2023

<https://doi.org/10.26877/eternal.v14.i1.14309>

Received Dec 30, 2022; Revised Jan 27, 2023; Accepted Feb 5, 2023

## The Effect of Inquiry-Based STEM Learning Strategy toward Students' Writing Abilities at Eighth Grade of SMP Negeri 15 Bengkulu City

<sup>1</sup>Lussy Erviona

<sup>2</sup>Ira Maisarah

<sup>3</sup>Iis Sujarwati

University of Bengkulu

Bengkulu, Indonesia

[\\*lussyerviona02@gmail.com](mailto:lussyerviona02@gmail.com)

[iramaisarah@unib.ac.id](mailto:iramaisarah@unib.ac.id)

[iisujarwati@unib.ac.id](mailto:iisujarwati@unib.ac.id)

**Abstract.** The objective of this study was to reveal the effects of Inquiry-Based STEM Learning Strategy toward students' writing ability at the eighth-grade students of SMP Negeri 15 Kota Bengkulu. Quasi-experimental design was implemented in this study. Eight grade students of SMP Negeri 15 Kota Bengkulu were participated in this study. The findings revealed a significant difference between the writing abilities of students taught using the Inquiry-Based STEM strategy and the writing abilities of students taught simply using scientific approach which is used as conventional techniques. It was found from the post-test results that there was significant effect toward students' writing ability after receiving six treatments. The results independent sample test revealed that the Inquiry-Based STEM technique had a significant impact toward students' writing abilities. The mean pre-test writing skill score for the control and experiment groups was found to be slightly comparable. However, the writing score of the experiment group was higher than the control group. Thus, it can be concluded that Inquiry-Based STEM strategy gives positive effect toward students' writing ability and is proved to be effective strategy in teaching writing. Finally, it is suggested that teachers comprehend and apply the Inquiry-Based STEM strategy while teaching writing because it has been demonstrated that this technique may improve the teaching learning process. It is also suggested that additional studies perform study on the use of the Inquiry-Based STEM method in various grades or schools.

**Keywords:** Inquiry-Based STEM, learning strategy, writing abilities

©Authors

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-SA 4.0).

## Introduction

Writing is one of the most essential abilities in using language particularly in written discourse for students to develop to master English. It is a complex skill which involves the process of creating or generating written materials (Renandya & Widodo, 2016). Before composing a writing, a student must decide what to write and what information should be included to transfer information effectively. Writing does not only use for daily communication, but it has also been an important skill for students in school. It is evident that the students use writing practically in most activity and lesson preserved in schools including tasks, assignments, and final exams (Dastgeer & Afzal, 2015). Therefore, writing is an essential skill in English Language Learning.

It is undeniable that most students consider writing to be challenging due to the complexity of several aspects in writing, including grammar, spelling, and vocabulary (Ismayanti & Kholiq, 2020). The students at junior high school learn about several genre of texts such as descriptive, narrative, recount, procedure, and report text. They should be able to write a meaningful text as one of each competency. Also, at this grade level teachers use writing tests to evaluate their students' proficiency in mastering English. While writing is one of compulsory skill in studying English at school, writing text is considered difficult for students, particularly for junior high school students in the eighth grade who are just learning English in their schools.

The goal of curriculum 2013 which is implemented In Indonesia is to be able to achieve certain values and to master knowledge and skills that were very distinct from the KTSP. Therefore, the main competence that is aimed at English language education is communicative competence. English skills are given top importance while teaching English to students because the activities in the Curriculum 2013 are created to expose students to the usage of English as much as possible with a variety of topics, settings, and difficulties as well as different genre of texts (Putra, 2014). Thus, the curriculum 2013 aims at encouraging students to be able to communicate spoken and written in various communication events.

Despite its importance, writing is still a challenging skill to learn, particularly when the writing must be done in a language other than one's native tongue. For students who do not speak English as a first language, writing in English might be frustrating. Yoandita (2019) stated that students had some difficulties with writing. The first difficulty is with the method of teaching and learning. Writing is frequently assigned as an assignment by the teacher, which they must do at home. The teachers only use lecturing method which is bored for students. The teachers just provide limited directions and does not provide any additional assistance. Therefore, the students just write down what they know, with no deeper understanding of their compositions.

Due to the problems above, it is evident that an instructional strategy that may help students overcome their writing difficulties is urgently needed. By using an effective strategy, so it is hoped that it will be beneficial for both the teachers and the students. The researcher searched an effective strategy for resolving the issues mentioned and found that STEM (Science, Technology, Engineering, and Mathematics) based on inquiry approach is one of effective

strategy currently used in English Language Teaching. Using English and STEM inquiry students are exposed to real-world training or social practice (Hoffman & Zollman, 2016). STEM learning is one of effective instructional strategies which can be applied in English Language Teaching.

Kurniawan (2022) argued that the application STEM inquiry provides two main benefits which are social connection and cognitive skills. Students might encourage themselves to engage with other students and develop their abilities in social life practice by using the phrase social interaction skill. Nevertheless, in the pedagogic skill term, students might improve their cognitive reasoning abilities to become able to think critically. For this reason, the teachers must be prepared with their knowledge and skills since they must instill multi-skills and information in their students since the application STEM inquiry demands a significant amount of work on the part of both teachers and students (Zhai, 2019). Therefore, it can be used in multilingual education programs.

Some studies have shown that STEM is applicable for junior high school students. Suprpto (2016) argued that STEM encouraged students at junior high schools to become critical thinkers which helps them become more effective problem solvers, self-reliant, thinkers, creators, innovators, logical thinkers, and technology literate. Junior high school students are between young and adult learners need exposures of higher order thinking skill. Murnawianto et al. (2017) also agreed by stating that scientific instruction that improves critical thinking abilities is required to equip students for the problems of the twenty-first century. STEM can be a useful way to progressively introduce STEM into study while also training students' critical thinking skill.

There are also studies that have been conducted on STEM strategy in English language teaching and writing strategies. From the results, it is found that that STEM strategy is applicable in teaching English. Toran et al. (2020) found that early STEM education that considers individual variability and is suited for children's developmental levels is shown to have a supporting role in concept acquisition and school readiness. Zhai (2019) also found similar result which the inquiry teaching method based on STEM educational practices has shown advantages in English Language Teaching and has the potential to significantly improve students' overall ability and professional quality; therefore, it should be considered for instructional strategy.

Wardani et al. (2020) investigated how scientific teaching materials for elementary school students through the Project-Based Learning approach may improve writing abilities. The results suggested that Project-Based Learning might improve pre-service teachers' abilities to create lessons that are appropriate for students' personalities, 21st-century skills, and the relevant curriculum. The Project-Based Learning approach is having an impact by using scientific teaching materials written by primary teacher students more often. The Project-Based Learning model may be employed as an alternate learning model to enhance the writing abilities of instructional materials for students.

Abdurahman et al. (2019) argued that the combination of the inquiry learning, and the STEM strategy helped to create the fictitious version of the inquiry-based STEM learning strategy. "*GUIDANCE*" steps have been recommended to implement STEM inquiry methodologies. The steps of *GUIDANCE* are described below.

a. Generating motivation and interest in science

During this stage, teachers share their own firsthand experiences with the students as they build concepts and define terms. The teachers may choose to begin by asking a question on a situation. The students must find this experience appealing and unusual. Students utilize a model to create an explanation of the occurrence they are seeing while raising problems. Through soft scaffolding, the teacher also increases students' motivation for and interests in science at this stage.

b. Upraising curiosity

The teacher facilitates interactive learning in this stage by modeling scientific techniques, performing experiments, and asking insightful questions. While the students identify the issues and items that may require scientific investigation, teachers can come up with questions that can be investigated to stimulate students' curiosity.

c. In depth discussion

In this stage, the teacher facilitates students to conduct experimental method formulation by supporting the discussion of problems, needs, or desires that have potential solutions. However, the students engage in extensive debates to create experimental plans that identify variables by utilizing simulations and models to review current solutions.

d. Analyzing

During this stage, the students perform experiments and gather relevant information by discovering strategies to obtain the information required to identify requirements and limitations and test design hypotheses. The students also use technology to build ideas for improvement and analyze data to determine the proper link between variables, explain failures, and design remedies.

e. Arranging

At this stage, the students create answers to the problems and comprehend how to apply existing information using a variety of representations. It implies that the students make a design for a solution employing a reasoned approach to problem-solving based on scientific knowledge and the model of the material world. By balancing the limitations and needs of the current conditions, the developed solution is made as optimal as possible.

f. Constructing ideas

In this stage, the students build concepts for brand-new actual problems throughout this phase. The students can create by sharing ideas, making design decisions, presenting arguments, referencing scientific theories, and establishing useful design guidelines.

Based on the explanation above, teaching writing is challenging in SMP Negeri 15 Kota Bengkulu due to lack of effective strategies in teaching writing. While there is a convenient condition in classroom, there is a gap in this problem which was derived from pre-observation activity. The results from previous studies suggest that it is important to implement STEM inquiry strategy in teaching. Therefore, this research is necessary and deserves to be carried out to reveal the effectiveness STEM inquiry on students' writing abilities at Eighth Grade of SMP 15 Kota Bengkulu”.

## Method

This study used a quasi-experimental design to collect empirical data on the use of Inquiry-Based STEM Strategy in students' writing. Quasi-experimental research aims to mimic the benefits of actual experimental design as nearly as possible in which some participants in a group receive treatment while others do not (Gopalan et al., 2020). This study was done at SMP Negeri 15 Kota Bengkulu Academic Year 2022/2023, with the subjects being class VIII.B as the experiment group and class VIII.C as the control group since the students in those groups had similar writing skills.

The pre-test and post-test control group design was used in this study. The experiment and control groups were given a pre-test and a post-test in this design. The pre-test was designed to see if the two groups could be compared before the treatment, but the post-test allowed the researcher to see how the treatment affected the end variables immediately. Rogers & Revesz (2019) stated that the experiment group engages in a treatment that may include a single teaching session or a series of them. Therefore, this research executed six teaching sessions both for experiment group and control group, so they had enough exposure in their learnings.

This research used inquiry-based STEM learning strategy. It was the combination of the inquiry learning and the STEM strategy helped to create the fictitious version of the inquiry-based STEM learning strategy. Abdurrahman et al. (2019) proposed "GUIDANCE" steps have been recommended to implement STEM inquiry methodologies. This strategy was implemented in the treatment for experiment group.

The data were taken from writing ability test. A writing test was administered as the pretest at the beginning of the term, and the second as the post-test at the conclusion of the term. They were experiments that ran in concurrently. Students were asked to create a short functional letter that was a letter in each test. The curriculum served as the idea for the topic of the letter used in this study. SPSS v.25 was used to analyze the data. Its objective was to determine the pre-test and post-test results. It included descriptive information, a normality test, a homogeneity test, and a sample test.

## Findings and Discussion

The findings included a data description, normality and homogeneity analysis, and data analysis using the independent sample t-test. The data was collected from pre-test and post-tests administered to the experiment and control groups. The difference in students' scores between the experiment and control groups on the aspect of writing skill was determined by comparing their scores before and after the treatment.

After the experiment group received treatment for six meetings, a post-test was administered to assess the group's progress. Both the experiment and control groups were given a post-test to assess how they performed. The post-test results for both groups were used to determine the highest, lowest, and mean scores.

**Table 1. Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test Experiment (Inquiry-Based STEM Learning Strategy)	20	58.5	72.5	65.875	4.1003
Post-Test Experiment (Inquiry-Based STEM Learning Strategy)	20	78.0	86.0	82.100	2.6931
Pre-Test Control (Conventional Method)	20	56.5	74.5	66.750	4.6552
Post-Test Control (Conventional Method)	20	72.0	84.0	77.725	3.4961
Valid N (listwise)	20				

The table above revealed that the mean score of the pre-test experiment group was 65,86, with the lowest score being 58.5 and the highest score being 72.5. The pre-test control group's mean score was 66.75, with the lowest score being 56.5 and the highest score being 74.5. The mean post-test experiment score was 82.1, with the lowest score being 78.0 and the highest being 86.0. The mean post-test control score was 77.73, with the lowest score being 72.0 and the highest score being 84.0.

### Normality Test

The researcher performed a normality and homogeneity test prior to testing the hypothesis. The normality test was used to determine whether the sample data was drawn from a normally distributed population. Further statistical tests needed a properly distributed sample population. If the assumption of normality was not genuine, the test findings would be inaccurate. In this study, the normality test employed Kolmogorov-Smirnov of SPSS v.25 for windows with criterion  $\rho > 0.05$ .

The output of normality test showed that (Sig.) for pre-test experiment group of Kolmogorov-Smirnov was  $0.200 > 0.05$ , indicating that the data of pre-test experiment group were normal, and (Sig.) for post-test experiment group of Kolmogorov-Smirnov was  $0.198 > 0.05$ , indicating that the data of post-test experiment group were also normal. The results of normality tests confirmed that (Sig.) for pre-test control group of Kolmogorov-Smirnov was  $0.120 > 0.05$ , indicating that the data of control group's pre-test were normal, and (Sig.) for post-test control group of Kolmogorov-Smirnov was  $0.200 > 0.05$ , indicating that the data of control group's post-test were also normal.

Therefore, it can be concluded that that (Sig.) for all data of the Kolmogorov-Smirnov test is greater than 0.05, indicating that all data were regularly distributed. Because the data were normally distributed, the parametric statistic tests, Paired-Sample T-Test and Independent-Sample T-Test, could be used to test the hypothesis; however, before applying independent sample t-test Analysis, the data had to be homogeneous.

### Homogeneity Test

Homogeneity test was purposed to examine if two or more populations had the same category variable distribution. Homogeneity means that the distribution



of results in each independent group is comparable. False findings may be achieved if independent groups were not similar in this regard. The output of homogeneity test revealed that (Sig.) based on mean was  $0.439 > 0.05$ , implying that the data variance of the post-test experiment group and post-test control group was homogeneous. As a result, one of the Independent-Sample T-Test criteria have been met.

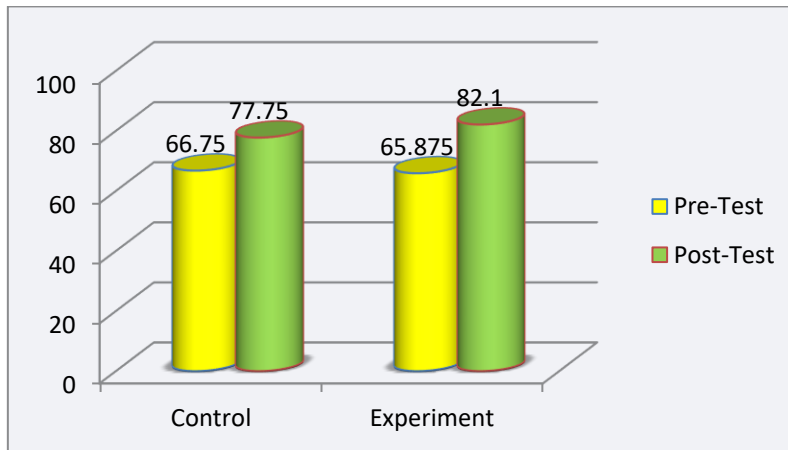
### **Hypothesis Testing**

The t-test was performed to determine the hypotheses posted. It means that if the t-value from the results shows that there is a significant difference between the two groups. The objective of employed paired sample test was used to find out the difference between the result of pre-test and post-test each group. It is used to determine the effect from each learning strategy used before and after the treatment. In this test, there were two pairs used to compare each result as pre-test and post-test of experiment group was set as paired 1, and pre-test and post-test of control group as paired 2.

The paired sample test findings showed that the Sig. (2-tailed) of pair 1 was  $0.000 < 0.05$ , implying that there was a significant difference in students' writing ability between the pre-test and post-test experiment group. Furthermore, the Sig. (2-tailed) was also  $0.000 < 0.05$ , indicating that there was a significant difference in students' writing skill between the pre-test and post-test control group.

The independent sample test was used to examine the significance of the difference between the experiment group and the control group following different treatments. The post test was completed after six meetings of Inquiry-Based STEM Learning Strategy treatments and six meetings of the conventional method (scientific approach), and it was examined for normalcy and homogeneity. Because the findings demonstrated that the data was normal and largely homogeneous, an independent sample test could be undertaken. The Independent-Sample T-Test, results showed that the Sig. (2-tailed) was  $0.000 < 0.05$ , so it can be concluded that there was significance difference of students' writing skill between post-test score of experiment group and post-test control group.

The post-test mean score of experiment group was 82.1 while the post-test mean score of control group was 77.73. Therefore, it can be concluded that the mean score of experiment group was higher than the mean score of control group. The comparison of mean score between pre-test and post-test is presented in the figure below.



**Figure 1. The Means Score of Pre-Test and Post-Test Results**

Based on the findings, the students' mean pre-test writing ability score for the control and experiment groups was 66.75 for the controlled group and 65.875 for the experiment group. In the post test, however, the experiment group's writing score was higher than the control group's, with 77.75 for the control group and 82.1 for the experiment group. The Sig. (2-tailed) from the independent sample test was 0.000 0.05, suggesting that  $H_0$  (null hypothesis) was rejected and  $H_1$  (alternate hypothesis) was accepted. Implementing the Inquiry-Based STEM technique to improve students' writing abilities had a significant effect as an outcome.

### Discussion

The findings of the study revealed the effect of Inquiry-Based STEM strategy. After receiving treatments, the experiment group showed a significant progress after receiving treatments by using Inquiry-Based STEM strategy. During the pre-test, the students from both the experiment and control groups experienced difficulties in writing English. They seemed confused in doing the test because they were afraid of making mistakes. There were some problems they faced during the pre-test. The first problem might be connected to the process of creating writing itself and the second problem was a lack of vocabulary. When the students ran out of words to write with, the students were stuck and did not write anything on the paper. From the pre-test, it is also found that the students were confused about how to connect ideas into a meaningful sentence.

After the pre-test, the experiment group received the treatment for six meetings. In the process of teaching writing, the inquiry-based STEM technique is quite helpful. It changed the regular educational environment they usually have into an interactive one. It keeps students from becoming bored while studying by using the conventional strategy. The conventional strategy used in the control group which is scientific approach may also be used to teach writing; however, only half of the students actively participated in the teaching learning process. In contrast, in experiment group, all students engaged in the conversation and writing process.



It is evident that students' writing abilities improved after six treatments were administered to the experiment group. The analysis of post-test results shows that the Inquiry-Based STEM technique had a beneficial impact on students' ability to write English. The control group's mean score did improve, but it did not significantly overlap with the experiment group's improvement. Although the traditional method increases students' writing exam results, it is incapable of keeping up with the progress provided by the Inquiry-Based STEM strategy.

Second, data analysis demonstrated that the Inquiry-Based STEM technique had a significant impact on the students' writing skills. It is discovered by comparing the results of the pre-test and post-test. After six treatments, the mean score of students taught using Inquiry-Based STEM techniques was greater than the students taught using the traditional scientific approach. The improvement in mean score achieved by students in the experiment group in the post-test demonstrates that Inquiry-Based STEM techniques were helpful in teaching writing.

Students who were taught using Inquiry-Based STEM strategies were more creative and engaged than students who were taught using conventional methods because this strategy stimulates the learner to think critically. Abdurrahman et al. (2019) argued that encouraging inquiry-based STEM education may improve students' engagement and attitude toward learning second language. Because of the integrated application of Inquiry-Based STEM strategy, the students will have the chance to improve their abilities via discovery and experimentation which is promoted in curriculum 2013.

The post-test results demonstrated a substantial difference in students' reasoning skills between the Inquiry-Based STEM technique and the traditional strategy. The t-test results demonstrate this. The t-count was calculated from the t-test and compared to the t-table value.

The Sig. (2-tailed) from the independent sample test was  $0.000 < 0.05$ , suggesting that  $H_0$  (null hypothesis) was rejected and  $H_1$  (alternate hypothesis) was accepted. Implementing the Inquiry-Based STEM technique to improve students' writing abilities had a significant effect as an outcome. In other words, there was a substantial difference between the pre-test and post-test results, indicating that the Inquiry-Based STEM technique is helpful in increasing students' writing abilities.

As mentioned earlier, although the conventional technique affected students' writing test scores, it cannot keep up with the development given by the Inquiry-Based STEM strategy. It may be happened due to several factors including external and internal factors (Yulyanah & Khotimah, 2021). Internal factors are such as students' health condition, motivation, and interest. Students' bad habits in learning also affect the learning outcome. On the other hand, external factors are the factors that are from environment such as unstable internet connection, lack of technology devices, and inability to manage an effective teaching.

The result of this research is accordance to Suprpto (2016) who argued that STEM learning allows junior high school students to become critical thinkers, which helps them become more effective in problem solving. Junior high school students, who are between young and adult learners, require higher order thinking skill exposure. Zhai (2019) also found similar result which the inquiry teaching

strategy based on STEM educational practices has proven beneficial in English Language Teaching and has the potential to considerably increase students' general ability and professional quality; consequently, it should be considered for instructional strategy.

Kurniawan (2022) argued that the application STEM inquiry provides two main benefits which are social connection and cognitive skills. By utilizing the phrase social interaction skill, students may motivate themselves to engage with other students and build their abilities in social life practice. Nonetheless, in terms of pedagogic competence, students may enhance their cognitive reasoning abilities to think critically. As a result, teachers must be ready with their knowledge and abilities because they must inculcate multi-skills and information in their students since the application STEM inquiry requires a large amount of work from both teachers and students.

Integrated Inquiry-Based STEM strategy also has a variety of benefits, including promoting scientific understanding at a young age and encouraging scientific interest and curiosity among the students. It allows the students to get a thorough grasp of STEM topics and how they are interconnected, as well as the possibility to address numerous STEM ideas concurrently through a richer learning environment than one with divided disciplines, thereby increasing efficiency. Murnawianto et al., (2017) argued that STEM integration had a good impact on student achievement. It enables students to be prepared for the rapidly changing and competitive job market by assisting students in understanding real-world situations so that they can meet the industries' growing needs, particularly in advanced scientific and technical skills, thereby contributing to global economic growth, advancement, and entrepreneurship.

Apart from all the advantages, there are also some weaknesses in integrating Inquiry-Based STEM strategy into English Language Teaching. The main weakness was the difficulty in drawing connections between the information and skills covered and real-world applications for students. It is critical to strike a balance between teacher engagement relevant to new concepts and student implementation in their study. Johnson et al., (2020) added that the weakness in using Inquiry-Based STEM strategy in teaching was the additional investment cost that may be required to support the shift to STEM integration. It may cost a lot of money for budget planning and the development of standard STEM equipment as a response to budget difficulties.

Although the conventional method, scientific approach, is still applicable in teaching writing; however, it is still not capable to catch the progress that provided by Inquiry-Based STEM strategy did. It is found from the mean score and t-test result which indicated Inquiry-Based STEM strategy did was an effective strategy. In conclusion, there was a significant effect between the writing ability of students who were taught using the Inquiry-Based STEM method and the writing ability of students who were simply taught using traditional techniques. As a result, the Inquiry-Based STEM technique was demonstrated to be one of the strategies that had a beneficial influence on students' writing skills.

## Conclusion

Based on the findings, it's indeed possible to summarize that there is a significant difference in writing ability between students who are taught using the Inquiry-Based STEM strategy and students who are taught by using scientific approach which was used as conventional techniques. It was discovered from the post-test results that it had a good influence on students' writing. The results of the independent sample test revealed that the Sig. (2-tailed) was  $0.000 < 0.05$ , indicating that the null hypothesis was rejected, and the alternative hypothesis was accepted. As a result, implementing the Inquiry-Based STEM strategy to increase students' writing abilities had a significant effect.

It is evidence that students' writing abilities improved after six treatments were administered to the experiment group. The analysis of pre-test and post-test results shows that the Inquiry-Based STEM technique had a beneficial influence on students' ability to write English. The mean pre-test writing skill score of students in the control and experiment groups was found to be slightly comparable. However, the writing score of the experiment group was greater than that of the control group in the post test. As a result, it can be stated that the Inquiry-Based STEM technique has a beneficial influence on students' writing abilities and has been proven to be a successful strategy for teaching writing.

There are some recommendations for teaching and learning activities in English. First, it is recommended that writing teachers use the Inquiry-Based STEM strategy while teaching writing since it has been shown to have a positive effect on the teaching learning process. Second, it is recommended that teachers thoroughly understand the process for implementing the Inquiry-Based STEM strategy in teaching writing so that they may effectively employ this strategy in the classroom. Finally, because this study has limitations, it is proposed that other researchers perform research on implementing the Inquiry-Based STEM technique in various grades or schools.

## References

- Abdurrahman, A., Nurulsari, N., Maulina, H., & Ariyani, F. (2019). Design and validation of inquiry-based STEM learning strategy as a powerful alternative solution to facilitate gift students facing 21st century challenging. *Journal for the Education of Gifted Young Scientists*, 7(1), 33-56.
- Abdurrahman, Ariyani, F., & Nurulsari, N. (2019). Designing an Inquiry-based STEM Learning strategy as a Powerful Alternative Solution to Enhance Students' 21st-century Skills: A Preliminary Research. *Journal of Physics: Conference Series*, 1155(1).
- Dastgeer, G., & Afzal, M. T. (2015). Improving English writing skill: A case of problem based learning. *American Journal of Educational Research*, 3(10), 1315-1319.
- Gopalan, M., Rosinger, K., & Ahn, J. Bin. (2020). Use of quasi-experimental research designs in education research: Growth, promise, and challenges. *Review of Research in Education*, 44(1), 218-243.

- Hoffman, L., & Zollman, A. (2016). What STEM teachers need to know and do for English language learners (ELLs): Using literacy to learn. *Journal of STEM Teacher Education*, 51(1), 9.
- Ismayanti, E., & Kholiq, A. (2020). An analysis of students' difficulties in writing descriptive text. *E-Link Journal*, 7(1), 10–20.
- Johnson, C. C., Mohr-Schroeder, M. J., Moore, T. J., & English, L. D. (2020). *Handbook of research on STEM education*. Routledge London, UK.
- Kurniawan, A. B. (2022). Potential Benefits of Combination of English Language Teaching and STEM. *2nd International Conference on Education and Technology (ICETECH 2021)*, 131–137.
- Murnawianto, S., Sarwanto, S., & Rahardjo, S. B. (2017). STEM-based science learning in junior high school: Potency for training students' thinking skill. *Pancaran Pendidikan*, 6(4).
- Putra, K. A. (2014). The implication of curriculum renewal on ELT in Indonesia. *Parole: Journal of Linguistics and Education*, 4(1 April), 63–75.
- Renandya, W. A., & Widodo, H. P. (2016). *English language teaching today: Linking theory and practice* (Vol. 5). Springer.
- Rogers, J., & Revesz, A. (2019). Experimental and quasi-experimental designs. In *The Routledge handbook of research methods in applied linguistics* (pp. 133–143). Routledge.
- Suprpto, N. (2016). Students' attitudes towards STEM education: Voices from Indonesian junior high schools. *Journal of Turkish Science Education*, 13(special), 75–87.
- Toran, M., Aydin, E., & Etgier, D. (2020). Investigating the effects of STEM enriched implementations on school readiness and concept acquisition of children. *Ilkogretim Online*, 19(1).
- Wardani, D. S., Fauzi, M. R., Zafira, R., & Kurniawati, D. (2020). Creating Props: Improving Writing Skills of Teaching Materials of Elementary Teacher Education Students through Project-Based Learning Model. *Elementary School Forum (Mimbar Sekolah Dasar)*, 7(2), 216–234.
- Yoandita, P. E. (2019). An analysis of students' ability and difficulties in writing descriptive text. *Jurnal JOEPALLT (Journal of English Pedagogy, Linguistics, Literature, and Teaching)*, 7(1).
- Yulyanah, Y., & Khotimah, H. (2021). Analysis of Internal and External Factors Affecting Students Learning Output Case Study D3 Accounting, Pamulang University, 2019/2020 Academic Year. *JIM UPB (Jurnal Ilmiah Manajemen Universitas Putera Batam)*, 9(2), 158–165.
- Zhai, L. (2019). An Inquiry Teaching Mode Based on STEM Education. *International Journal of Emerging Technologies in Learning*, 14(17).