ISSN (PRINT) : 2549-9955 ISSN (ONLINE): 2549-9963
JURNAL ILMIAH PENDIDIKAN FISIKA
https://ppjp.ulm.ac.id/journals/index.php/jipf/index

Critical Thinking Skills Improvement of Students Through Guided Inquiry Learning Model with Scientific Approach

Rheima Affilia, Laili Komariyah*, and Shelly Efwinda
Physics Education Study Program, Faculty of Teacher Training and Education
Universitas Mulawarman, Samarinda, Indonesia
*laili.komariyah@fkip.unmul.ac.id

Abstract

The COVID-19 pandemic pushed many schools to create hybrid learning systems due to drastic changes in the learning environment. Technology and knowledge have advanced swiftly in the 21st century. As the foundation of education, the school is expected to foster students' 4C skills, one of which is critical thinking. This study aimed to analyze how students' critical thinking skills changed after studying harmonic motion using the guided inquiry model and scientific approach. The study used a quantitative method with the pre-experimental design's one-group pre-test post-test procedure. A 10-question essay was used to obtain data from 31 students in grade X IPA 3. The findings indicated that students' critical thinking skills improved, with an N-Gain score of 0.72. As well as implications for this study, there were significant differences in critical thinking participants were educated with the T-test sample pair after using the santific suppression with the guided inquiry model.

Keywords: Critical Thinking Skills; Guided Inquiry Model; Scientific Approach

Received : 28 August 2022
Accepted : 2 March 2023
Published : 12 March 2023
DOI : https://doi.org/10.20527/jipf.v7i1.6255

How to cite: Affilia, R., Komariyah, L., & Efwinda, S. (2022). Critical thinking skills improvement of students through guided inquiry learning model with scientific approach. *Jurnal Ilmiah Pendidikan Fisika*, 7(1), 91-99.

INTRODUCTION

Education is a key factor in advancing a nation and its society overseas and at home, particularly in Indonesia. In Indonesia, the total population is required to complete a nine-year compulsory basic education program. Education in Indonesia has implemented the 2013 curriculum system to prepare students to face global challenges. The issues of global challenges at hand are technological advancements, the environment, a knowledge-based industry, and others (Dewi et al., 2018; Sudarmaji et al., 2021). Learners who are educated and knowledgeable are desperately required to address these global challenges. This is because scientific learning is more relevant and effective to be developed and applied to school students. This type of learning has been implemented in our curriculum, namely the 2013 curriculum, which employs scientific approach-based learning. The scientific approach is a learning activity that can help students

comprehend and recognize content by developing aspects of scientific work. This scientific approach-based learning can improve intellectual abilities, particularly critical thinking and higher-order thinking skills (Dewi et al., 2018; Farindhani & Wangid, 2019; Ristanto et al., 2020).

Critical thinking skills are fundamental and effective in all aspects. The skill to think critically is essential for students and must be taught at a young age at home, school, and in the community. In the twenty-first century, the development of science is growing rapidly in all fields, including technology and information, to the point where it can affect our lives today. Hence, teachers must also prepare students to train their digital literacy skills by changing learning skills and innovations. Consequently, the quality of education in Indonesia must be improved, and schools as an educational foundation to explore knowledge and information must be demanded to have creative thinking, critical thinking, problem-solving, communication and collaboration skills so that these skills can be said to be 4C (Misbah et al., 2018; Saregar et al., 2021; Septikasari, 2018; Yani et al., 2021). However, these skills are still not completely achieved in many schools. This is due to the process of learning activities, which generally do not encourage students to develop these skills, especially the skill to think critically. Hamdani, et al. (2019) also explained that learning activities in the classroom emphasize cognitive aspects that are only in the form of memorization, which impacts learning outcomes. Therefore, students' poor critical thinking skills are caused by the classroom's ineffective learning activities.

Learning innovations are required to improve student's critical thinking skills. To enhance critical thinking skills, one of the learning innovations that can be used is to use various learning models such as Inquiry-Based Learning, Problem-Based Learning (PBL), Discovery Learning, Project Based Learning (PjBL), and many more. Therefore, the researchers selected an inquiry-based learning model with a scientific approach, specifically the guided inquiry. In this model, students are encouraged to be more active. In addition, this model encourages students to be able to take the initiative when observing and inquiring about a given problem, to propose explanations related to what they observe, then to design and conduct an experiment to support or oppose the theories that they obtain, to analyze the data, and draw conclusions from the data obtained from the experiment (Kurniasih et al., 2017).

Based on the results of observations and interviews with one of the physics teachers at Madrasah Alliyah Negeri (MAN) 1 Samarinda, it was found that the critical thinking abilities of tenth-grade students were still below the critical thinking criteria, namely the 40% average critical thinking skill of the students at MAN 1 Samarinda. During the learning process, the absence of critical thinking skills is suspected. A significant number of students still participate less actively in class discussions; as a result, they are more likely to imitate without the curiosity to solve problems and to lack an in-depth understanding of concepts to explain commonplace physics phenomena. Although teachers in the field of physics have attempted to increase class hours, there are still students who have not been able to develop their critical thinking skills to their fullest potential. The difficulty experienced by the students is when a teacher presents a problem on simple harmonic vibration material, which is closely related to everyday phenomena; students have difficulty comprehending and solving the problem presented (Rahmat et al., 2019).

The results of this description conclude that applying a scientific

approach with a guided inquiry learning model can improve students' critical thinking skills studying harmonic vibration material. The advantages of this scientific approach are that students become active, making them more centered during learning activities and that they can also develop their characters (Rhosalia, 2017). Moreover, according to Muazizah et al. (2016), the guided inquiry learning model is a presentation activity that enables students to form and develop their concepts to comprehend the fundamental concepts and remember the material over time. Therefore, it is essential to conduct this research to improve students' critical thinking skills. Sukini (2019) argues that using a scientific approach with a guided inquiry model is appropriate because students will be actively and critically engaged. The objectives to be achieved in this study are to improve the critical thinking skills of tenth-grade students using a scientific approach with a guided inquiry learning model and to determine whether there is a significant difference in the critical thinking skills of the tenth-grade students using a scientific approach with a guided inquiry learning model.

METHOD

This study employed a quantitative approach, and the research method chosen was a pre-experimental design with One Group Pretest-Posttest. The learning model used in this research was a scientific approach with a guided inquiry model to seek influence before and after receiving treatment in learning activities. Due to the research's design, only a single class was utilized. The sampling technique used was snowball sampling, so researchers chose a class as a case study, namely X IPA 3 at MAN 1 Samarinda, as a sample because their critical thinking skills must be improved. The data collection technique employed was a test. The test used in this study was a cognitive written test in the form of an essay consisting of ten standardized questions.

RESULT AND DISCUSSION

Before applying a scientific approach with a guided inquiry model, the researcher administered a pretest to the students to measure their initial skills of the students. The data obtained showed the average pretest result of 23.48. Pretest data is presented in Figure 1.

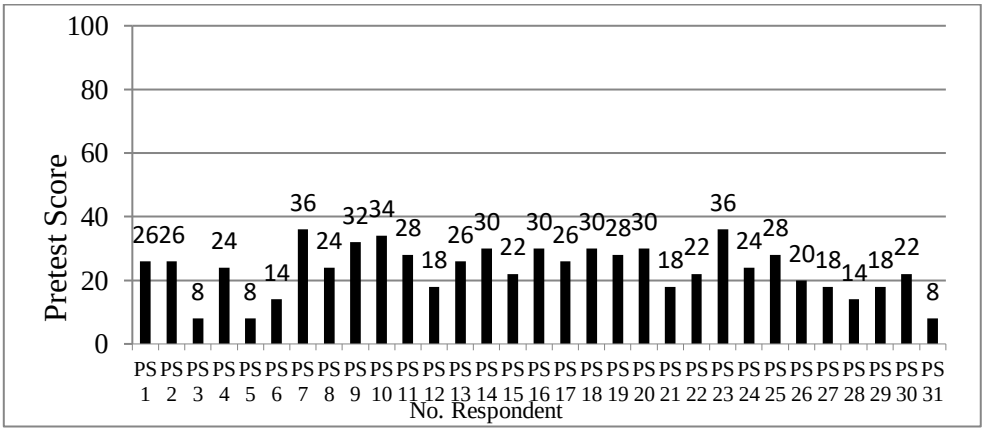

Figure 1 A bar chart of the students' pretest scores

It can be observed that the minimum average pretest score for the students is 8, while the maximum average pretest score for the students is 36. This is because the students are still less focused on the learning activities. Therefore, the researchers classified the students' pretest results based on the critical thinking skills presented in Table 1.

Tabel 1 The percentage of the score category of critical thinking skill (pretest)

Score Scale	Category	The total of the students	Percentage
$80 \leq x \leq 100$	Very critical	0	0%
$65 \leq x < 80$	Critical	0	0%
$55 \leq x < 65$	Quite critical	0	0%
$40 \leq x < 55$	Less critical	0	0%
$0 \leq x < 40$	Not critical	31	100%

Based on the learning that the researchers have carried out by applying a scientific approach to the guided inquiry model in X IPA 3 class MAN 1 Samarinda The purpose of this posttest is to assess the extent to which students' critical thinking skills have improved as a result of the learning activities applied in the classroom. The following are the results of the students' post-test scores assessed after learning, which are depicted in a bar chart (Figure 2).

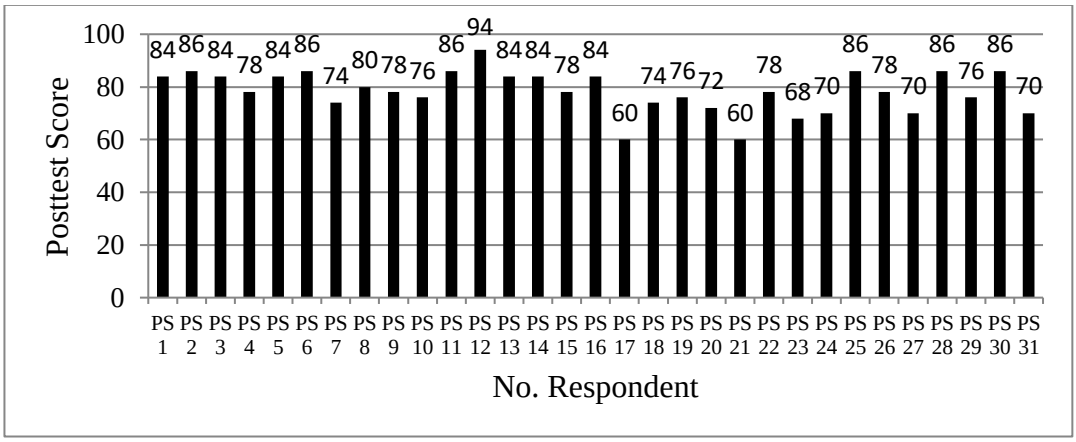

Figure 2 A bar chart of the students' posttest scores

The average posttest score of X IPA 3 class students at MAN 1 Samarinda calculated is 78.39, and this average meets the Minimum Completion Criteria (KKM) at MAN 1 Samarinda, which is 76. The researcher then classifies the obtained scores according to the critical thinking skills presented in Table 2.

Table 2 The percentage of the score category of critical thinking skill (posstest)

Score Scale	**Category**	**The total of the students**	**Percentage**
$80 \leq x \leq 100$	Very critical	13	41,9%
$65 \leq x < 80$	Critical	16	51,6%
$55 \leq x < 65$	Quite critical	2	6,5%
$40 \leq x < 55$	Less critical	0	0%
$0 \leq x < 40$	Not critical	0	0%

Normality Test Analysis

The normality test used in this research is the Shapiro-Wilk test, which is particularly effective for analyzing small data samples. If the significance level value is greater than 0.05, data can be categorized according to normal distribution. The results of the pretest and posttest data normality test can be seen in Table 3.

Table 3 The normalty test result of pretest and posttest

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Score	.111	31	.200	.952	31	.173
Posttest Score	.180	31	.011	.936	31	.062

Based on the data that has been obtained, it is seen that the result of the normality test on the pretest score data is 0.173, and the result of the normality test on the posttest score data is 0.062. It can be demonstrated through the significance value of the normality test that both the pretest and posttest data are normally distributed.

Normalize Gain Test

Normalize Gain is used to determine whether or not there is an increase between the pre-test and post-test scores of the students. The results of the N-Gain analysis of the improvement of the student's critical thinking skills are presented in Table 4.

Table 4 The results of N-Gain analysis

Pretest Average	Posttest average	*N-Gain*	Criteria
23.48	78.39	0.72	High

Based on the N-Gain results, the criteria for improving critical thinking skills through pretests and posttests can be determined based on the N-Gain value acquired by each student. Fourteen students have improved their critical thinking skills by 45.2%, meeting the medium criteria. Meanwhile, the remaining seventeen students reached high criteria in improving critical thinking skills by 54.8%.

Paired Sample T-Test

The paired t-test is used to determine whether or not there is a significant increase in the students' critical thinking skills.

Table 5 The result of Paired Sample T-test

Paired Sample Test						
	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pretest Posttest	-54.903	11.864	2.131	-25.766	30	.000

Based on the data that has been obtained, it can be seen that the obtained significance value is smaller than 0.05, specifically 0.000. Therefore, from the results obtained, it can be concluded that there is a significant increase from the study.

In this study, the researchers conducted four meetings at MAN 1 Samarinda, each consisting of approximately 90 minutes of lessons (2 x 45 minutes) using a hybrid learning system in X IPA 3 class and a physics laboratory with 31 students. The students were given a pretest on the first meeting, and on the fourth meeting, they were given a posttest. During the pretest exam, some students (part A) took the pretest in X IPA 3 class, while others (part B) took the pretest via MAN 1 Samarinda e-learning, in which the test was distributed, and the results were collected via the Whatsapp application. All students worked in X IPA 3 class while

doing the posttest exam. For the pretest and posttest, ten essay questions served as the test instrument. The test questions are intended to assess critical thinking skills.

In learning activities by applying a scientific approach using a guided inquiry model, several stages of learning will become a unity between the model and the approach. The first stage, namely orientation, is a stage in which the students are given a problem in the form of a video or activity worksheet so that they can observe the problem. The researcher will then ask the students questions as the beginning of the learning activity. The second stage, namely formulating the problem, consists of a series of problems related to the material to be presented so that the students are intrigued and challenged to think. The third stage, namely formulating a hypothesis, consists of several temporary solutions to problems previously formulated by the students under the teacher's guidance. The fourth stage, namely collecting information or data, is an activity that directs the students to collect information or data that has been obtained and determine whether the collected information or data supports the provisional answer (hypothesis). The fifth stage is formulating conclusions, which is an activity following information or data collection. Then the students present the results of the completed worksheet in front of the class.

The results of the first hypothesis test, namely obtaining an increase in the value of critical thinking skills, are the average pre-test score of 23.48 and the average post-test score of 78.39, resulting in an N-gain analysis with high criteria of 0.76. Therefore, it can be concluded that there is an increase in the students' critical thinking skills in class X MAN 1 Samarinda after the learning activity using a scientific approach with a Guided Inquiry learning model on harmonic vibration material. The second hypothesis test yielded a significant value of 0.000, which is less than 0.05, indicating that there is a significant difference in the critical thinking skills of the tenth-grade students of MAN 1 Samarinda after the learning activity using a scientific approach with a guided inquiry learning model on harmonic vibration material.

Based on the data obtained, applying a scientific approach using a guided inquiry model can improve students' critical thinking skills. Although included in the high category, some students still get scores below the Minimum Completion Criteria at MAN 1 Samarinda school, which is 76. This is due to the fact that there are still some students who are less focused when absorbing learning material. With this hybrid learning system, the students who study at home cannot properly follow the lessons, and some do not follow online learning. Many students turn off their cameras during online learning, making it difficult for researchers to determine whether or not students understand the lesson at home. In addition, some students enter the zoom meeting room late so that other students have to wait. This can cause learning hours to be delayed. There are even some students who are absent from the zoom meeting. Furthermore, many students are late in submitting assignments, which presents a further obstacle.

During the learning process, the researcher provided orientation in the form of an animated video and problems in the form of student worksheets about the material to be studied regarding harmonic vibration. The students were presented with problems that applied concepts from everyday life so that they could comprehend the meaning of the problems. Regarding the problem to be solved, the students must formulate a temporary answer (hypothesis) while guided by the researcher. Then, the students analyze the hypothesis through

Phet experiments and information-gathering activities. After completing the information-gathering and experimentation activities, the students can observe the comparison between the hypothesis and the collected data. If the students' hypotheses regarding the given problems are appropriate, they can increase their understanding of the material they are learning; if the hypothesis does not match the facts, it can provide understanding or insight to the students. After the students had analyzed the hypothesis, they presented the results of their worksheets in front of the class.

This study's results align with the notion that applying a scientific approach with a guided inquiry model can improve students' critical thinking skills and make it easier for them to comprehend the studied material. This scientific approach can assist teachers in developing more varied learning activities, such as observing, questioning, gathering information, processing information, and communicating, so that students can optimize the development of their potential to improve their learning outcomes. This is in accordance with the opinion of Siahaan & Pane, (2021). Whereas the guided inquiry learning model, according to Sukma et al., (2016), has the advantage in which the students can design and find their own physics concepts. Moreover, this model helps the students to retain the material they have learned longer. According to Muazizah et al. (2016), this guided inquiry learning model can fundamentally shape and develop students, which means that students will reach a fundamental level of understanding to remember the material they have learned. Therefore, in this study, the improvement of the students' critical thinking skills has been analyzed to reveal that 45.2% of the students in the medium category and 54.8% in the high category are improving their critical thinking skills. This explains that employing a scientific method and a Guided Inquiry model during the learning process can make students more active and critical.

The advantage of this study's results, showing that students' critical thinking skills are improved after applying a scientific approach with a Guided Inquiry model, is that this study can help students improve their abilities and cognitive processes. Furthermore, by applying this approach and model, students can strengthen their understanding and memory of the material they have learned, as they tend to be more active independently and in groups.

Applying a scientific approach with a guided inquiry model in learning can enhance students' critical thinking skills regarding harmonic vibration material. This is consistent with previous research by Aji et al. (2017), which found that applying the guided inquiry learning model with a scientific approach makes it easier for students to comprehend the studied physics concepts, enhancing their critical thinking skills. In this hybrid learning, students are free to learn to discover their knowledge apart from the instructional materials provided by the researcher through madrasah e-learning. In addition, students can learn independently through instructional materials provided before learning begins by using madrasah e-learning which can be accessed anytime and anywhere, thereby improving students' understanding. This is in line with Hong et al., (2021), who stated that critical thinking skills and attitudes could be developed in online inquiry-based learning; therefore, online learning can pave the way for students to improve inquiry-based learning. Consequently, such a system can be regarded as an effective learning tool. In addition, according to Lieung et al. (2020) regarding the scientific approach, which reveals that the approach can aid students in learning if the steps are carried out

effectively, then students' critical thinking skills can be maintained or even enhanced. The shortcomings of this study are that when conducting research using madrasah e-learning due to the fact that the school utilized a hybrid learning system, the researcher often faced problems to log in. Therefore, the suggestion for future researchers is to create their platform using Google Classroom or their own WhatsApp group.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the critical thinking skills of the students in class X MAN 1 Samarinda increased after using the scientific approach with the guided inquiry learning model, from an average obtained pre-test score of 23.48 (not critical) to an average post-test score of 78.39 (critical) with an N-gain score of 0.72 (high).

REFERENCES

Aji, S. D., Bernadino, A., & Hudha, M. N. (2017). Inkuiri terbimbing dengan pendekatan saintifik (scientific approach) untuk meningkatkan berpikir kritis. *Momentum: Physics Education Journal*, *1*(2), 140. https://doi.org/10.21067/mpej.v1i2.2148

Dewi, C., Astuti, B., & Nugroho, S. E. (2018). Kemampuan berpikir kritis siswa melalui pembelajaran discovery learning berbantuan bahan ajar fisika berbasis pendekatan saintifik. *UPEJ Unnes Physics Education Journal*, *7*(2), 22–28. https://doi.org/10.15294/upej.v7i2.27464

Farindhani, D. A., & Wangid, M. N. (2019). Scientific-based pictorial storybook with project-based learning method for improving the critical thinking skills of elementary school students. *Jurnal Prima Edukasia*, *7*(1), 94-105.

Hamdani, Prayitno, & Karyanto. (2019). Meningkatkan kemampuan berpikir kritis melalui metode eksperimen. *Proceeding Biology Education …*, *16*(Kartimi), 139–145. https://jurnal.uns.ac.id/prosbi/article/view/38412

Hong, J. C., Hsiao, H. S., Chen, P. H., Lu, C. C., Tai, K. H., & Tsai, C. R. (2021). Critical attitude and ability associated with students' self-confidence and attitude toward "predict-observe-explain" online science inquiry learning. *Computers and Education*, *166*(February), 104172. https://doi.org/10.1016/j.compedu.2021.104172

Jonathan, D. A., & Effendi, I. (2020). Analisis pengelolaan dalam upaya menjaga tingkat likuiditas perusahaan bongkar muat (pbm) pt. tao abadi jaya jakarta periode tahun 2011-2016. *Jurnal Ilmiah Manajemen Dan Bisnis*, *1*(April), 5–24. https://doi.org/https://doi.org/10.31289/jimbi.v1i1.366

Kanginan, M. (2013). Fisika Untuk SMA/MA Kelas X (A. D. W, Supriyana, & Syarifuddin (eds.); kedua). Jakarta: Erlangga. https://doi.org/98765

Kurniasih, Imas, & Sani, B. (2017). *Ragam pengembangan model pembelajaran untuk peningkatan profesionalitas guru* (CV. Solusi Distribusi (ed.); Cetakan Ke). Yogyakarta: Kata Pena.

Lieung, K. W., Rahayu, D. P., & Fredy. (2020). Scientific approach to improve the critical thinking skills. *Education and Humanities Research*, *473*(Icss), 480–483. https://doi.org/10.2991/assehr.k.201014.105

Misbah, M., Mahtari, S., Wati, M., & Harto, M. (2018). Analysis of students' critical thinking skills in dynamic electrical material. *Kasuari: Physics Education Journal (KPEJ)*, *1*(2), 103-110.

Muazizah, N. M., Nurhayati, S., & Cahyono, E. (2016). Keefektifan penggunaan e-learning berbasis moodle berpendekatan guided inquiry terhadap hasil belajar siswa. *Jurnal Inovasi Pendidikan Kimia*, *10*(2), 1760–1768.

Rahmat, R., Suwarma, I. R., & Imansyah, H. (2019). Penerapan model pembelajaran problem based learning berbasis multirepresentasi untuk meningkatkan kemampuan berpikir kritis siswa sma pada materi getaran harmonik. *Prosiding Seminar Nasional Fisika (E-Journal) SNF 2019*, *8*, SNF2019-PE-101–106. https://doi.org/10.21009/03.snf2019.01.pe.13

Rhosalia, L. A. (2017). Pendekatan saintifik (scientific approach) dalam pembelajaran tematik terpadu kurikulum 2013 versi 2016. *JTIEE (Journal of Teaching in Elementary Education)*, *1*(1), 59. https://doi.org/10.30587/jtiee.v1i1.112

Ristanto, R. H., Djamahar, R., Heryanti, E., & Ichsan, I. Z. (2020). Enhancing students' biology-critical thinking skill through CIRC-Based scientific approach (Cirsa). *Universal Journal of Educational Research*, *8*(4A), 1-8.

Saregar, A., Cahyanti, U. N., Misbah, M., Susilowati, N. E., Anugrah, A., & Muhammad, N. (2021). CORE learning model: Its effectiveness towards students' creative thinking. *International Journal of Evaluation and Research in Education*, *10*(1), 35-41.

Septikasari, R. dan R. N. F. (2018). Keterampilan 4c abad 21 dalam pembelajaran pendidikan dasar. *Jurnal Tarbiyah Al Awlad*, *VIII*, 107–117. https://doi.org/https://onesearch.id/Record/IOS15151.article-1597

Siahaan, F. E., & Pane, E. P. (2021). Penerapan pendekatan saintifik berbasis model pembelajaran guided inquiry untuk meningkatkan soft skills mahasiswa pendidikan fisika. *Jurnal Basicedu*, *5*(4), 2541–2549. https://doi.org/10.31004/basicedu.v5i4.1230

Sudarmaji, H., Prasojo, G. L., Rubiono, G., & Arif, R. (2021). Pendidikan vokasi aviasi: Peluang dan tantangan. *SKYHAWK: Jurnal Aviasi Indonesia*, *1*(1), 1-6.

Sugiyono, S. (2019). Metode penelitian pendidikan (kuantitatif, kualititatif, kombinasi, R&D, dan penelitian pendidikan) (A. Nuryanto (ed.); Edisi Keti). Bandung: Alfabeta.

Sukini, S. (2019). Penerapan pembelajaran guided inquiry berbasis pendekatan saintifik untuk meningkatkan aktivitas dan hasil belajar kognitif biologi siswa kelas xi mipa sma negeri 3 dumai. *Journal of Natural Science and Integration*, *2*(1), 105. https://doi.org/10.24014/jnsi.v2i1.7118

Sukma, S., Komariyah, L., & Syam, M. (2016). Pengaruh model pembelajaran inkuiri terbimbing (guided inquiry) dan motivasi terhadap hasil belajar fisika siswa. *Saintifika*, *18*(1), 59–63.

Surya, Y. (2009). Seri bahan persiapan olimpiade fisika getaran dan gelombang (Tim PT Kadel (ed.); Pertama). Tanggerang: PT Kadel.

Yani, M., Mastuang, M., & Misbah, M. (2021). Development of solid elasticity modules with guided inquiry model to train critical thinking skills. *Kasuari: Physics Education Journal (KPEJ)*, *4*(1), 44-56.