

EFFECT OF THE GUIDED INQUIRY LEARNING MODEL ASSISTED BY SCIENTIFIC WORKSHEET TOWARD CRITICAL THINKING SKILLS

Beta Kurnia Illahi¹, Yurnetti^{1*}

¹ Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia

Corresponding author. Email: yurnetti@fmipa.unp.ac.id

ABSTRACT

The learning model is still teacher-centered and needs to use teaching materials that support the learning process, which causes students' critical thinking skills to be underdeveloped. One learning model that can improve students' critical thinking skills is a learning model that involves active and student-centered students is the guided inquiry learning model. The applied guided inquiry learning model must have supporting media and teaching materials. Teaching materials that are practical and operational in the guided inquiry learning model are scientific worksheets. This study aims to determine the effect of the guided inquiry learning model assisted by scientific worksheets on the critical thinking skills of class XI natural science students. This research method is quasi-experimental with a randomized control group-only design. The population of this research is class XI natural science one of the Islamic senior high school in West Sumatra, Indonesia. Sampling was carried out using a purposive sampling technique in which the research results concentrated on critical thinking skills taken through critical thinking questions in the form of essays. The data in this study were analyzed using descriptive analysis and two average similarity tests. Data analysis showed that $\bar{x}_e > \bar{x}_c$, Then a t-test was carried out with the results of the t-count test of 3.47 with t-table 1.99 indicating that t-count is outside the acceptance area of H_0 , meaning that H_1 is accepted, that is, there is a significant influence of the Scientific worksheet on students' critical thinking skills.

Keywords: Guided Inquiry Learning Model, Scientific Worksheet, Critical Thinking Skills



Physics Learning and Education is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

I. INTRODUCTION

Education is a process of providing various kinds of situations to humans that aim to empower and develop themselves [1]. Education is crucial for developing Human Resources that can keep up with modern times and scientific and technological advancements. To make this happen, humans must have 4C competencies (Critical Thinking, Creative Thinking, Collaboration, and Communication) [2].

A high-quality education system is required to meet the country's educational objectives. Excellent learning produces high-quality education [3]. The ability to innovate and improve human quality depends on education. Modern education is defined by 21st century education. The information age of the 21st century is where education is taking place [4]. The demands of the 21st century will drive further advancement in education. The application of science and technology to all facets of life distinguishes this. The ability to master many abilities is a requirement of existence in the 21st century. Therefore, education is anticipated to produce human resources who develop various talents to become effective and qualified people[5].

The government has undertaken some attempts to raise the standard of education in Indonesia, one of which is improving the curriculum [6]. Development of the curriculum, specifically the education unit level curriculum, 2013 curriculum, and now an independent curriculum. An independent curriculum is one of the curriculum concepts that demands independence for students and educators. Independence in the sense that every student and educator is given the freedom to access knowledge obtained from formal and non-formal education [7].

The independent curriculum also attempts to improve students' abilities to observe, inquire, reason, and articulate what they learn or discover after instruction [8]. The independent curriculum strongly emphasises cognitive skills and the learning process. The learner-centred learning strategy, which calls for students to have an active role and be able to do their research during the learning process, is used to carry out the learning process in the autonomous curriculum for all levels [9]. Physics and the Natural Sciences are two subjects covered in formal education [10].

The physics learning process based on the independent curriculum is directed at scientific activities using scientific models.[11] In practice, students are trained to be creative, innovative and able to build their own understanding through the scientific process, or a student-centered learning process.[12] One of the learner-centered learning models is the guided inquiry learning model [13]. Using a learning model that can involve engaged learners, as well as the applied learning model, must be able to highlight the curiosity and experience of the learners. Inquiry learning aims to foster systematic, logical, and critical thinking skills and intellectual development. The guided inquiry learning model is one of them. In the guided inquiry learning paradigm, students are merely given a problem, topic, and question. Nevertheless, they are heavily guided by the teacher while they carry out the procedures and analyze the data and conclusions [14]. The seven learning steps of the inquiry paradigm include problem-defining, developing hypotheses, conducting experiments, evaluating data, testing ideas, drawing conclusions, and presenting results [15].

Teaching resources and accompanying media are required for the use guided inquiry learning model. Student worksheet are helpful and functional teaching resources for the guided inquiry learning approach [16]. No matter how well the description of the activities in the syntax of the learning model will not be operational without the help of the student worksheet. Previously, there were student worksheet to help learning physics, but the student worksheet that had been prepared had not used this approach. So that the steps in the student worksheet are not clearly described. One approach that is suitable for student worksheet with the guided inquiry learning model is a scientific approach [17]. Scientific worksheet contains the steps of a scientific approach, namely observing, asking, experimenting, associating, and communicating. Observing is an activity that provide focus in observing an object. After observing students are directed to ask and answer questions that include factual, conceptual, and procedural questions[18]. Through the use of scientific worksheet and inquiry learning models can hone students' scientific and scientific process skills so that they can increase students critical thinking skills [19]. The study "Application of the Guided Inquiry Learning Model to Improve Critical Thinking Ability and Scientific Attitude of High School Students" claimed that the use of the guided inquiry learning model improved students' critical thinking abilities and scientific attitudes in physics lessons and that students responded favourably to its use [20].

This study differs from earlier studies in that it was carried out using a guided inquiry learning strategy using scientific worksheets. The guided inquiry learning model uses scientific worksheets to assist in the learning process. Based on observations in one of the Islamic senior high school in West Sumatra, Indonesia. it is clear that students there are engaged in their education, which is necessary for the guided inquiry learning model with scientific worksheet to function as intended. In addition, observations also show that students' critical thinking skills in one Islamic senior high school still need to be classified as developed. This can be seen in the results of the analysis of daily tests using critical thinking indicator questions in physics learning, showing that the average critical thinking ability of class XI natural science students can be seen in Figure 1:

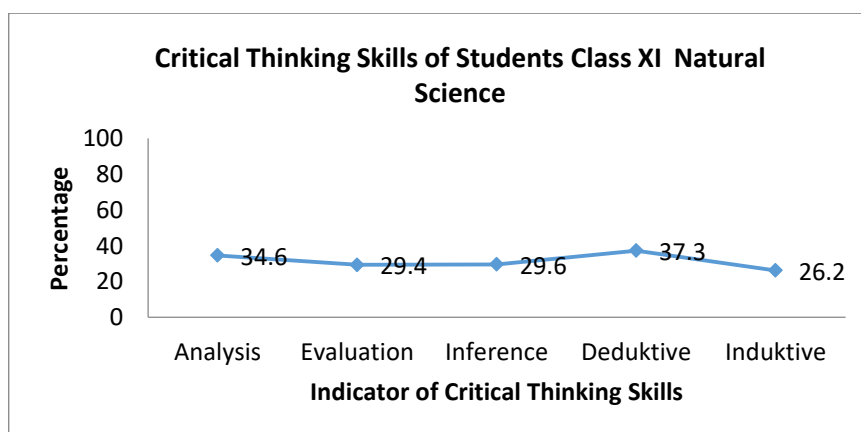


Fig. 1. Graph Critical Thinking Skills of Student Class XI Natural Science

Figure 1 illustrates how students' critical thinking skills in class XI natural science at one of the Islamic senior high school in West Sumatra, Indonesia are still in the developing stage and require development.

Based on the background that has been described, researchers are interested in doing research. As research title is "Effect of The Guided Inquiry Learning Model Assisted by Scientific Worksheet Toward Critical Thinking Skills". This study aimed to determine how the guided inquiry learning paradigm, supported by Scientific worksheet, affected student class XI natural science critical thinking skills.

II. METHOD

A quasi-experiment was the research design used in this investigation. It's a good idea to have a backup plan if it doesn't work out. The fact that there is no random or non-random selection of groups in a quasi-experimental design prevents it from adequately controlling external variables that influence the execution of experimental research[21]. Research that tests the results of administering various treatments to diverse groups is known as empirical research. Randomized control group only will be the research methodology used. The research methodology to be used is shown in Table 1.

Table 1. Randomized Control-Group Only Design

Group	Pre-test	Treatment	Post-test
Experiment	-	X	T2
Control	-	-	T2

(Source: Ref [22])

Information :

X = Learning using Scientific worksheet

T2 = Final test after being given treatment

The class XI natural science at one of the Islamic senior high schools in West Sumatra, Indonesia students enrolled in the 2023–2024 academic year comprised the population for this study. Purposive sampling was used as the sampling technique in this study, with the number of classes taught by educators considered.

The impact of scientific worksheet is the study's independent variable. The study's dependent variable is students in class XI natural science at one of the Islamic senior high schools in West Sumatra, Indonesia critical thinking skills. The study's controls were the 2013 curriculum-aligned materials, identical starting skills between the two classrooms, equal learning time, similar resource books, comparable teachers, and matching numbers and exam questions.

Data on students' critical thinking skills as determined by their knowledge competency was used in this study. Information about knowledge competency was gathered through a written test using essay questions with markers of critical thinking skills. These numbers are original data. The knowledge competency data analysis method uses the two average similarity test. Do normality and homogeneity tests first, then perform a similarity test for the two averages.

III. RESULTS AND DISCUSSION

A. Results

The findings of the last test (posttest), which consisted of 10 essay-style questions and was administered to students after the study, provided information on critical thinking skills. The two sample classes received equal treatment when administering this test. In Table 2, you can examine the sample class's data processing analysis outcomes.

Table 2. Average Value, Highest Value, Lowest Value, Standard Deviation and Sample Class Variance

Class	Highest Value	Lowest Value	\bar{X}	S^2	S
Experiment	97	60	82,00	78,971	8,8866
Control	93	53	74,45	77,923	8,8274

Table 2 shows that the experimental class's average score on the critical thinking scale is greater than the control class's. Because the practical class's standard deviation is lower than the control class's standard deviation, the experimental class's pupils' talents are more evenly dispersed than those of the control class. The Control class has a higher variance than the Experimental class. This demonstrates that the control class students' levels of competence differ more from those of the experimental class students. By performing a test for the similarity of the two means, it is possible to assess whether or not the difference in the final test results between the two sample classes is significant.

After the study meeting, a posttest was used to analyze the data about attaining knowledge competency. A study of the normality test and homogeneity test is first performed to identify the statistics utilized in generating conclusions based on the data in Table 1. The normalcy test used in this study is the Lilliefors test. Table 3 contains the findings of the normality test for the two sample groups.

Table 3. Results of the Normality Test for the Two Sample Classes

Class	N	α	L_0	L_t	Information
Experiment	36	0,05	0,1388	0,1477	Normal
Control	31	0,05	0,1039	0,1591	Normal

Table 3 shows that the $L_0 < L_t$ values for the two sample classes are significant at 0.05. This indicates that the final test results for both sample groups are drawn from populations with a normal distribution. A homogeneity test was performed to determine if the variance between the two sample classes was homogeneous. The F test was used to conduct the homogeneity test. Table 4 displays the homogeneity test results for the two sample classes.

Table 4. Homogeneity test results of the two sample classes

Class	N	S^2	F_h	F_t	Information
Experiment	36	78,97	0,986	1,825	Homogeneous
Control	31	77,92			

According to Table 4, the sample has a value of $F_h < F_t$. This indicates a homogeneous variance in the data of the two sample classes. The final test data's normality and homogeneity tests revealed that both sample classes had homogenous variance and were usually distributed. Hence the t-test was chosen as the hypothesis test for the two sample classes, as shown in Table 5.

Table 5. Hypothesis t test Results Learning Outcomes of Sample Class

Class	N	\bar{X}	S	t_h	t_t
Experiment	36	82	8,88	3,47	1,99
Control	31	74	8,82		

Based on Table 5 that $t_{count} = 3.47$ while $t_{table} = 1.99$ with the test criteria in the acceptance area H_0 at a significant level $\alpha = 0.05$ and $dk = 65$ from the distributed table t obtained $t_{(0,975)} = 1,99$. H_0 acceptance criteria if $-t_{(0,975)} < t_{count} < t_{(0,975)}$. It means that the price of $t = 3.47$ is outside the H_0 acceptance area. Thus, the t_{count} value is in the H_1 acceptance area. These results indicate that the accepted hypothesis is that there is an influence of the guided inquiry learning model assisted by scientific worksheet on the critical thinking skills of students in class XI natural science at one of the Islamic senior high schools in West Sumatra, Indonesia.

The critical thinking skills of the students in the two sample classrooms varied. Figure 2 illustrates that the experimental class has a higher percentage of students with critical thinking skills than the control class, as determined by the student's knowledge competency.

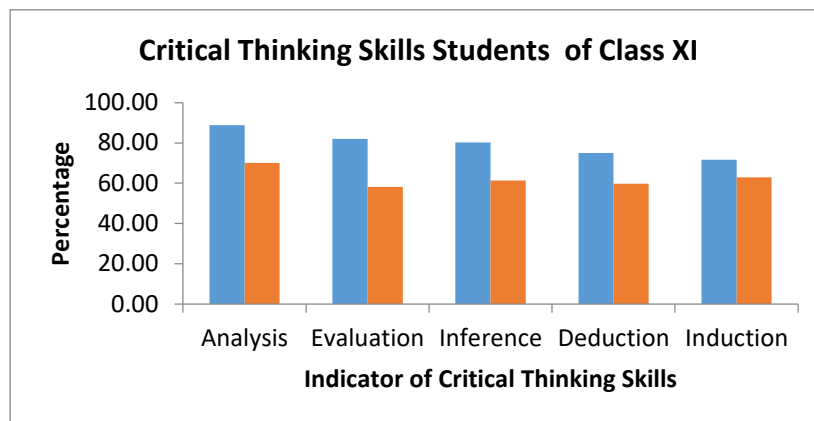


Fig. 2. Graph of Critical Thinking Skills Students in The Sample Class

Figure 2 illustrates how the experimental and control classes place different values on critical thinking abilities. Students in the practical class performed better than those in the control class on every measure of critical thinking ability. The experimental class received different treatment than the control class, which is why there was a difference science worksheets aid learning in the practical type but not in the control group.

The relation between the two variables, namely critical thinking skills and scientific workbooks, is ascertained using product-moment correlation analysis. Then, Pearson's Product-moment correlation analysis was carried out. After the product moment analysis test, the scientific worksheet contributed to the ability of students in class XI natural science at one of the Islamic senior high schools in West Sumatra, Indonesia by 20.6485% and the remaining 79.3514% was determined by other variables.

B. Discussion

The results indicated that the average critical thinking skill of students in the experimental class was greater than that of students in the control class, with the experimental class averaging 82.00 and the control class averaging 74.45. Since the sample was normally distributed and the variance was homogeneous, a t-test was conducted. The value of this was in the H_0 resistance region at a significance level of 5%. This indicates an average difference between the two courses; the average difference in critical thinking abilities between the experimental and control classes results from the therapy given to the experimental class in the form of science worksheets.

The guided inquiry learning approach, aided by scientific worksheets, improves students' critical thinking skills because guided inquiry syntax encourages students to think critically. The only difference between the guided inquiry learning model and the open inquiry learning model is the question-asking activity. In the open-inquiry learning approach, students individually pose questions, whereas the teacher poses questions in the guided inquiry model. In guided inquiry learning [23], the teacher presents various questions to design investigations, generate data experiments, and analyze and explain the results.

The same instructional materials are utilized with the same learning model in both the experimental and control classes. In the experimental class, scientific worksheet teaching materials were used, and students in the experimental class were required to bring cell phones and use them during glasses learning. In contrast, standard worksheet teaching materials were used in the control class. Learning with scientific worksheet requires students to study independently with their groups and execute scientific learning processes based on scientific worksheet.

This worksheet makes studying more engaging and enjoyable by inviting students to interact directly with technological advancements. Student Worksheets play a large and significant role in the learning process because they can increase student activity in learning, develop process skills, optimize learning outcomes, and help teachers direct their students to discover concepts through their activities [24]. A scientific approach is one suitable method for worksheets using the guided inquiry learning paradigm [25].

Scientific worksheet includes the steps of a scientific method, including observation, inquiry, experimentation, association, and communication. Using scientific worksheet and inquiry learning models,

students' scientific and scientific process abilities can be honed to improve their critical thinking. Students can learn to utilize scientific worksheets with or without the aid of educators. According to the requirements of the autonomous curriculum, student-centered learning, which is the principal learning activity among students and educators, can only guide and facilitate the learning process.

Teachers and students require worksheet that are geared toward a scientific approach, and these worksheets can serve as a resource for practical learning tools that address inadequacies in existing worksheets. However, this study demonstrated that scientific worksheets could enhance students' critical thinking skills [26].

To determine the significance of the relationship between scientific worksheet and critical thinking skills, the researcher conducted a product-moment correlation analysis with random sample requirements, standard variables X and Y for scientific worksheet and critical thinking skills, and linear variables X and Y for determining the correlation coefficient between variables X and Y. This is to the results of Dian's research [27], which states a positive relationship between student worksheets and student's critical thinking skills. The scientific worksheet contributes to the ability of class XI natural science students by 20.6485%, while the rest, 79.3514%, is determined by other variables. So, one might say applied student worksheets have a positive effect on students' critical thinking skills but not maximal. Needs repair in worksheets and problems used that hone students to can think critically so that results are desired can be achieved.

C. CONCLUSION

After conducting research using scientific worksheets and data processing, disparities in the findings of critical thinking skills were obtained in the experimental and control classes. The implementation of the guided inquiry learning model assisted by student worksheets has a positive influence on students' critical thinking skills. So, the application of the guided inquiry learning model with the help of student worksheets can improve students' critical thinking skills

ACKNOWLEDGMENT

I am grateful to the Department of Physics at Universitas Negeri Padang, the Physics Lecturers at Pillar of Physics Education Journal, and all the other contributors who helped to make this paper possible. Hopefully, many readers will find this helpful material.

REFERENCES

- [1] Undang-undang No. 20 tahun 2003 tentang Sistem Pendidikan Nasional. Jakarta: Indonesia.
- [2] Septikasari, R., & Frasandy, R. N. "Keterampilan 4C abad 21 dalam pembelajaran pendidikan dasa," *Tarbiyah Al-Awlad: Jurnal Kependidikan Islam Tingkat Dasar.*, vol. 8, no. 2, 2018, doi:10.15548/alawlad.v8i2.1597.
- [3] Baro'ah, S. "Kebijakan merdeka belajar sebagai strategi peningkatan mutu pendidikan". *Jurnal Tawadhu*, vol. 4, no. 1, 2020.
- [4] Suryani, N., Yurnetti, Y., Putra, A., & Desnita, D. "The Effect of Use Video in The Model of Guided Inquiry Learning on Traveling Waves and Sound Waves Materials in Class XI SMA Negeri 7 Sijunjung", *Pillar of Physics Education*, vol.13, no.3, 2021
- [5] Fernando, Trio Junira, Yenni Darvina, Silvi Yulia Sari, Letmi Dwiridal, and Fanny Rahmatina Rahim. "The Effect of Hots-Oriented Worksheets with Barcode Assistance in Online Learning on Critical Thinking and Creatives of Students of Class XI SMAN 1 HARAU." *Pillar of Physics Education*, vol. 14, no. 1, 2021, doi: <http://dx.doi.org/10.24036/10679171074>
- [6] Kurniawati, F. N. A. "Meninjau Permasalahan Rendahnya Kualitas Pendidikan Di Indonesia Dan Solusi". *Academy of Education Journal*, vol. 13, no. 1, 2022, doi:.47200/aoej.v13i1.765.
- [7] Angga, A., Suryana, C., Nurwahidah, I., Hernawan, A. H., & Prihantini, P. (2022). "Komparasi Implementasi Kurikulum 2013 dan Kurikulum Merdeka di Sekolah Dasar Kabupaten Garut.," *Jurnal Basicedu*, vol. 6, no. 4, 2022.
- [8] Munawar, M. (2022). "Implementasi Kurikulum 2013 Pada Mata Pelajaran Al Qur'an Hadist Di SMK Muhammadiyah 2 Blora," *JURNAL PEDAGOGY*, vol. 15, no. 1, 2022.
- [9] Saputro, A. N. C., Suhelayanti, S., Chabibah, N., Bermuli, J. E., Sinaga, K., Fauzi, A., ... & Fayanto, S. (2021). *Pembelajaran Sains*. Yayasan Kita Menulis.

- [10] Chodijah, S., Fauzi, A., & Ratnawulan, R. "Pengembangan perangkat pembelajaran fisika menggunakan model guided inquiry yang dilengkapi penilaian portofolio pada materi gerak melingkar," *Jurnal Penelitian Pembelajaran Fisika (JPPF)*, Vol. 1, no. 1, 2012, doi:10.24036/jppf.v1i1.603.
- [11] Wae, V. P. S. M., & Kaleka, M. B. U. "IMPLEMENTASI ETNOSAINS DALAM PEMBELAJARAN IPA UNTUK MEWUJUDKAN MERDEKA BELAJAR DI KABUPATEN ENDE," *OPTIKA: Jurnal Pendidikan Fisika*, vol. 6, no. 2, 2022, doi:10.37478/optika.v6i2.2218.
- [12] Yurnetti, M. "Pengaruh penerapan LKS berbasis conceptual understanding procedures (CUPS) terhadap kompetensi belajar IPA siswa kelas VII SMPN 3 Lengayang," *PILLAR OF PHYSICS EDUCATION*, 12(1) vol. 12, no. 1, 2019, doi:10.24036/5085171074
- [13] Amijaya, L. S., Ramdani, A., & Merta, I. W. "Pengaruh model pembelajaran inkuiri terbimbing terhadap hasil belajar dan kemampuan berpikir kritis peserta didik," *Jurnal Pijar Mipa*, 13(2), vol. 13, no. 2, 2018, doi:10.29303/jpm.v13i2.468
- [14] Zuriyani, E "Strategi Pembelajaran Inkuiri pada Mata Pelajaran IPA," *Jurnal of Widiyaiswara BDK Palembang*. 2010
- [15] Ratnasari, D., Yurnetti, Y., Hidayati, H., & Syafriani, S. "Pengaruh penerapan model pembelajaran inkuiri tipe pictorial riddle berbantuan media pembelajaran interaktif terhadap pencapaian kompetensi IPA siswa kelas VIII SMPN 31 Padang," *PILLAR OF PHYSICS EDUCATION*, 13(2). vol . 13, no. 2, 2020, doi: 10.24036/8454171074.
- [16] Hifarianti, V., Putra, A., & Syafriani, S. "Desain LKPD Berorientasi Kompleksitas Konten dan Proses Kognitif pada Materi Vektor untuk Pembelajaran Fisika SMA/MA," *Pillar of Physics Education*, 9(1) vol. 9, no.1, 2017, doi: 10.24036/2532171074.
- [17] Marlina, D., Kapur, K., Azzahra, N., & Desnita, D. "META ANALISIS PENGARUH PENGGUNAAN LKS TERHADAP KETERAMPILAN BERFIKIR KRITIS SISWA SMA DALAM PEMBELAJARAN FSKA" *Jurnal Pendidikan Fisika Undiksha*, vol. 11, no. 2, 2021, doi: 10.23887/jppf.v11i2.36686.
- [18] Aulyana, F., Putra, A., & Yurnetti, Y. "Pengaruh Penggunaan Lkpd Berorientasi Kompleksitas Konten Dan Proses Kognitif Dalam Model Pembelajaran Problem Based Learning Terhadap Pencapaian Kompetensi Fisika Peserta Didik Kelas X SMAN 7 Padang," *Pillar of Physics Education*, vol. 9, no. 1, 2017, doi: 10.24036/2514171074.
- [19] Irwansyah, M., & Perkasa, M. (2022). *Scientific Approach dalam Pembelajaran Abad 21*. Penerbit NEM.
- [20] Parwati, G. A. P. U., Rapi, N. K., & Rachmawati, D. O. "Penerapan model pembelajaran inkuiri terbimbing untuk meningkatkan kemampuan berpikir kritis dan sikap ilmiah siswa SMA," *Jurnal Pendidikan Fisika Undiksha*, vol. 10, no. 1, 2022, doi: 10.23887/jppf.v10i1.26724.
- [21] Sugiyono. 2018. *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta
- [22] Djamas, D. 2015. *Modul Metodologi Penelitian Pendidikan Fisika*. Cetakan ke-1. Padang
- [23] Retnosari, N., Herawati S., and Hadi., "Pengaruh model pembelajaran inkuiri terbimbing berbantuan multimedia interaktif terhadap berpikir kritis siswa kelas XI SMA Negeri di bojonegoro." Vol. 1, no. 8, 2016, doi: <http://dx.doi.org/10.17977/jp.v1i8.6635>
- [24] Hikmah, N., Arifin, A., and Sirajuddin., S. "Pengaruh Penggunaan Lembar Kerja Peserta Didik (LKPD) Berbasis Pendekatan Saintifik Terhadap Motivasi Belajar Dan Hasil Belajar IPS." *Phinisi Integration Review*, vol. 5, no.1, 2022.
- [25] Kurniawati, D Masykuri, M., and Saputro, S., "Penerapan model pembelajaran inkuiri terbimbing dilengkapi lks untuk meningkatkan keterampilan proses sains dan prestasi belajar pada materi pokok hukum dasar kimia siswa kelas x mia 4 sma n 1 karanganyar tahun pelajaran 2014/2015." *Jurnal Pendidikan Kimia*, vol. 5, no. 1, 2016.
- [26] Prasetya, E, and Suparman S. "Analisis kebutuhan E-LKPD dengan pendekatan saintifik untuk menstimulus kemampuan berpikir kritis." *Science, Technology, Engineering, Economics, Education, and Mathematics*, vol. 1, no. 1, 2020.
- [27] Fitriana, D., Yusuf, M. and Susanti, E., "Pengembangan lembar kerja siswa menggunakan pendekatan saintifik untuk melihat berpikir kritis siswa materi perbandingan", *Jurnal Pendidikan Matematika*, vol.10, no.2, 2016