The Use of Inquiry-Based Mobile Pocket Book on Students' Knowledge Based on Critical Thinking Skills on Global Warming

Sarwanto [1*), Valinda Putri Febrianti [2], Shofi Hikmatuz Zahroh [3]
Universitas Sebelas Maret, Indonesia[1,2,3]
[*)Corresponding E-mail: sarwanto@fkip.uns.ac.id

ABSTRACT

The purpose of this study was to analyze: (1) differences in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes on Global Warming material, (2) differences in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material, (3) interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material. This study used a quasi-experimental method with a sample of grade XI students' divided into two classes. The data analysis technique used was Kruskal-Wallis Test. The results showed: (1) there is a difference in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes, (2) there is no difference in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material, (3) there is an interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material.

INTRODUCTION

The level of success of national education goals can be known through learning outcomes based on the achievement of educational taxonomy [1]. In learning activities, students receive learning outcomes after an assessment at the end of the activity. Learning outcomes show the growth and development of student's capacity to master the material provided by the teacher [2]. Learning outcomes are divided into three domains based on Bloom's Taxonomy, namely knowledge, attitudes, and skills. In the knowledge domain, learning outcomes are measured based on mastery of concepts or material so that it involves more of the brain to think [3]. Based on data from the Physics End of Semester 1 Assessment at one of the high schools in Boyolali Regency, not a few students get Physics learning outcomes below the Minimum Completeness Criteria. Students' low knowledge learning outcomes indicate that there are still obstacles in mastering the material and receiving learning so it will be difficult when working on problems. Students' obstacles when receiving learning are influenced by

external factors, namely learning activities which include the use of inappropriate models, methods, media, and learning resources [4].

In Physics learning activities, there is still a lot of teacher-centered learning so students listen more than participate in learning activities [5]. If these activities are applied to Global Warming material, then students will only get an understanding of the material from the listening process alone and affect the learning outcomes received. In addition, in Global Warming material, students are involved in the decision-making process on global issues regarding environmental problems that must be resolved so critical thinking skills are needed. This shows that changes need to be made in the delivery of learning materials if teachers want students to master the Global Warming material. These changes include using learning models that help develop critical thinking skills, the use of methods that encourage student participation and interaction in the classroom, and the use of media that make it easier to illustrate learning materials.

The inquiry learning model is a model that can influence students' critical thinking skills because students are given the opportunity to learn the material by investigating facts, concepts, and principles based on their personal experiences [6]. The application of the inquiry model needs to be supported by the discussion method because students can share thoughts about the knowledge they have gained and utilize it to solve problems and hone their critical thinking skills [7]. In addition, learning media is also needed that can help provide an overview of the problem so that the problem-solving process can run easily [8]. Learning media that can be used to teach Global Warming material is a mobile pocket book [9]. The mobile pocket book is composed of several components such as text, images, audio, video, and animation but in the development process, there are no restrictions on the utilization of components to be used so that mobile pocket books made between developers experience differences.

Mobile pocket book affects student knowledge learning outcomes on temperature and heat material. This can be seen from the calculation of the correlation between learning outcomes and mobile pocket book which shows a positive value with $r_{count} = 0,58 > r_{table} = 0,33$ [10]. Not only mobile pocket books, external factors such as critical thinking skills also affect student knowledge learning outcomes. Previous research shows that there is a positive relationship between critical thinking skills and knowledge-learning outcomes, which indicates that critical thinking skills affect students' knowledge-learning outcomes [11]. When compared to students with low critical thinking skills, students with high critical thinking skills had superior learning outcomes. Both research results show their influence on knowledge learning outcomes, therefore this study aims to analyze: (1) differences in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes on Global Warming material, (2) differences in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material, (3) interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material.

METHOD

This research was conducted in one of the State High Schools in Boyolali in class XI of the 2022/2023 academic year. The research method used was a quasi-experiment with a 2x2 factorial design. The independent variables of this study are mobile pocket book and electronic book, the dependent variable is knowledge learning outcomes, and the moderator variable is critical thinking skills. The sampling technique used was cluster random sampling and two classes were selected to be used in the study. Before the research, the samples must first be tested for normality, homogeneity, and differences using the t-test. The test results showed that the XI MIPA 1 and XI MIPA 2 classes were selected as samples in the study. XI MIPA 1 class was used as an experimental class using mobile pocket book and XI MIPA 2 class was used as a control class using electronic book.

This study used documentation and test data collection techniques. The documentation technique was used to obtain data on students' initial abilities in the form of documents of Physics semester 1 final

assessment scores (PAS) while the test technique was used to measure the learning outcomes of students' knowledge and critical thinking skills. Learning instruments consist of lesson plans and student worksheets while data collection instruments include knowledge learning outcomes assessment and critical thinking skills assessment. Both data collection instruments are in the form of tests, so it is necessary to analyze the items, including validity, difficulty level, discrimination power, distractor effectiveness, and reliability.

Based on the results of the selection of items, there were 15 questions selected as a test for assessing student knowledge learning outcomes with questions that included 4 questions in the easy difficulty category, 8 questions in the moderate category, and 3 questions in the difficult category. The reliability of the test instrument is 0.7706 and is included in the high category. In addition, there are 5 questions selected as test questions for assessing students' critical thinking skills with questions that fall into the category of moderate difficulty level as many as 4 questions and difficult as many as 1 question. The reliability of the test instrument is 0.5564 and is included in the moderate category.

RESULTS AND DISCUSSIONS

The research data obtained includes data on students' critical thinking skills and data on students' knowledge-learning outcomes. Critical thinking skills data were obtained through a description test with a total of 5 items based on Ennis' critical thinking skills indicators. Data on students' critical thinking skills in each class are shown in Table 1.

Table 1. Data on Students' Critical Thinking Skills

Class	Number of Students	Highest Score	Lowest Score
Experiment	35	88.25	39.00
Control	35	95.00	15.00

The categorization of students' critical thinking skills is based on the median value [12]. The median value of the two classes is 74.44 so students who score above the median are included in the high critical thinking category and students who score below the median are included in the low critical thinking category. In the experimental class, 16 students' had high critical thinking skills, and 19 students' had low critical thinking skills. In the control class, 19 students' had high critical thinking skills and 16 students' had low critical thinking skills.

Data on student knowledge learning outcomes were obtained through a multiple-choice Global Warming material knowledgeability test with a total of 15 items. Data on student knowledge learning outcomes are shown in Table 2.

Table 2. Data On Student Knowledge Learning Outcomes

Class	Number of Students	Average	Highest Score	Lowest Score
Experiment	35	56,95	66,67	40,00
Control	35	45,71	66,67	33,33

Table 2 shows that the average knowledge learning outcomes of experimental class students are higher than the control class. Although there is a difference in mean and standard deviation, the highest value in each class shows the same value while the lowest value is different with the control class getting the lowest value. The frequency distribution of students' knowledge learning outcomes can be seen in Table 3 and Table 4.

Table 3. Frequency Distribution of Knowledge Learning Outcomes of Experimental Class Students'

Interval	Frequency	Percentage	Cumulative Percentage
40 – 46	1	3%	3%
47 – 53	12	34%	37%
54 – 60	8	23%	60%
61 – 67	14	40%	100%
Total	**35**	**100%**	

The distribution of data on student knowledge learning outcomes in the experimental class when presented in the form of a histogram does not form a normal data distribution curve. This can occur because the mean, median, and mode values are at different points, with a mean value = 56.95, median = 60.00, and mode = 66.67.

Table 4. Frequency Distribution of Knowledge Learning Outcomes of Control Class Students'

Interval	Frequency	Percentage	Cumulative Percentage
33 – 39	5	14%	14%
40 – 46	7	20%	34%
47 – 53	15	43%	77%
54 – 60	6	17%	94%
61 – 67	2	6%	100%
Total	**35**	**100%**	

The distribution of data on student knowledge learning outcomes in the control class when presented in the form of a histogram forms a normal data distribution curve but the shape of the curve is not symmetrical. This can occur because the median and mode values are at the same point while the mean value is at a different point with a mean value = 45.71, median = 46.67, and mode = 46.67.

Students' knowledge-learning outcomes are also grouped by the critical thinking skills category. Data on the grouping of learning outcomes based on these categories are presented in Table 5.

Table 5. Data on Students' Knowledge Learning Outcomes Based on Critical Thinking Skills Categories

Critical Thinking Skills	Number of Students	Students' Learning Outcomes		
		Average	Highest	Lowest
High	35	52,95	66,67	33,33
Low	35	49,72	66,67	33,33

The average knowledge learning outcomes of students who fall into the high and low critical thinking skills categories have differences but the differences are not significant. Higher average knowledge learning outcomes were achieved by students with high critical thinking skills.

Before being used to test the hypothesis, a prerequisite analysis test was conducted to ensure that the data on students' knowledge learning outcomes were analyzed with parametric or non-parametric statistics. The analysis test includes a normality test and a homogeneity test. The normality test results using the Lilliefors method showed that both classes did not come from normally distributed populations. Furthermore, the results of the homogeneity test using the Levene method showed that the variances of the two samples were not equal. The results of the analysis requirements test showed that the samples did not meet the assumptions of the parametric test because they were not normally distributed so a non-parametric test was used.

The research hypothesis test used is the Kruskal-Wallis non-parametric test. The Kruskal-Wallis test is a test shown to test for differences in k-independent samples with ordinal scaled data. The Kruskal-Wallis test was conducted using IBM SPSS Statistics 25 software with α = 5%. The results of the Kruskal-Wallis test and its discussion on each hypothesis are described as follows.

There is a difference in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes on Global Warming material

The results of hypothesis testing show that the Kruskal-Wallis H value or H_{count} is 19.407 so the value is greater than the χ^2_{table} with df = 1, which is 3.841. The Asymp Sig. value obtained is 0.000 so the value is smaller than the significance level of 0.05. The results of this hypothesis test calculation show that H_0 is rejected so that H_1 is accepted. The accepted H_1 shows that there is a difference in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes on Global Warming material.

Mobile pocket book is a learning media that affects student knowledge and learning outcomes. Knowledge-learning outcomes of students who use mobile pocket books are higher than students who do not use mobile pocket books [13]. Mobile pocket book is defined as learning media in the form of digital pocket books that can be accessed via smartphones [14] and is included in the type of multimedia learning media [15]. Multimedia learning media is composed of various combinations of components, namely text, audio, photos, video, and animation, but there is no specific guideline for the use of components so developers are free to combine the components used [16].

Mobile pocket book and electronic book are composed of the same components, namely text, images, and videos. However, there are differences in the placement of components on the student worksheets (LKPD) in the two mobile pocket books. The components in the mobile pocket book LKPD are text and video while in the electronic book LKPD are text and images. Previous research shows that the use of videos and images has a varied or different effect on student learning outcomes [17]. Students who use videos have higher learning outcomes than students who use images because videos can help understand the material being studied and can show events or phenomena that students may not be able to see on their own [18].

In the mobile pocket book, the video displayed is a video that explains the causes and effects of global warming on human life on Earth. Through the video, students can know the picture that occurs so that they can prepare efforts to control it. This is reinforced that through videos students' can imagine if they are in an event so that they can develop their thinking [19]. Whereas in the electronic book, the images displayed are graphical images of temperature increase, comparison of greenhouse gas emission maps, and comparison of area maps via Google satellites. The basis for selecting these images is so that students can analyze the information provided but in reality, there are still many who experience confusion in the process of analyzing images. Previous research shows that the use of images is less able to convey information realistically so it is less effective to use [20]. Research conducted also shows that through the use of image media, students tend to be less active when participating in learning activities [21].

Not only are there differences in the components used in LKPD, but the process of working on LKPD on the mobile pocket book and electronic book is also different. The mobile pocket book LKPD is done online through the application while the electronic book LKPD is done through paper. In the implementation of the study, students who were given the treatment of using the mobile pocket book looked enthusiastic about working on the LKPD directly in the application. This finding confirms the findings of previous researchers which show that students are more interested in the process of working on LKPD online compared to printed LKPD because working on LKPD online is a new experience for students. Students' interest in working on the LKPD turned out to affect the learning outcomes obtained. Students who use LKPD online have higher knowledge-learning outcomes [22].

In the class that was given the treatment of using the electronic book, the LKPD distributed was printed LKPD so that the work process was carried out by writing on paper. When printed LKPDs were distributed, students' looked unenthusiastic. This finding is reinforced by the results of previous research which shows that students feel bored when working on printed LKPD because these learning activities tend to be monotonous so student learning motivation continues to decrease [23]. The use of

printed LKPD is very dependent on words so it can make it difficult for students to understand the information in it [24]. Based on the exposure of research results and previous research, it can be concluded that the use of mobile pocket book has a better effect on student learning outcomes.

There is a difference in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material
The results of hypothesis testing show that the Kruskal-Wallis H value or H_{count} is 1.489 so the value is smaller than the χ^2_{table} with df = 1, which is 3.841. The Asymp Sig. value obtained is 0.222 so the value is greater than the significance level of 0.05. The results of this hypothesis test indicate that H_0 is accepted. The accepted H_0 shows that there is no difference in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material.

Critical thinking skills are related to the ability to analyze and identify so that they can solve problems and make the right decisions [25]. In this study, the test results showed that there was no significant difference in the influence of critical thinking skills with high and low categories on students' knowledge learning outcomes on Global Warming material. This is in line with previous research which shows that there is no effect of critical thinking skills on knowledge-learning outcomes [26].

The characteristics of Global Warming material are different from Physics material in general because there are no equations and only consist of reading. Students tend to memorize material that consists of reading because memorization is one way to remember the material. The results of previous research show that material that requires memorization is less suitable for measuring critical thinking skills because it has nothing to do with memorization ability [27]. Students who have high critical thinking skills are not necessarily reliable in memorizing so they get high knowledge learning outcomes. In addition to the characteristics of the material, the test instrument used also affects measuring student knowledge and learning outcomes based on critical thinking skills. There are two test instruments in this study, namely the knowledge learning outcomes test instrument and the critical thinking skills test instrument. Both instruments have different indicators. The test instrument for student knowledge learning outcomes is in the form of multiple choice with Bloom's Taxonomy indicators from levels C1 to C4 while the critical thinking skills test instrument is in the form of a description with indicators based on Ennis.

Although there are differences in indicators for measuring learning outcomes of knowledge and critical thinking skills, there are still indicators that have similarities so the two are still interrelated [28]. These indicators are analysis and evaluation. In Bloom's Taxonomy, analysis is the stage of dividing information into small parts and rearranging them into relevant parts to reveal the direction of a problem. This stage is the same as the stages in critical thinking because it requires students to identify, investigate, categorize, differentiate, and reorganize information. Furthermore, at the evaluation stage based on Bloom's Taxonomy, there are indicators of criticizing and criticizing activities that are the core of the critical thinking process. In Bloom's Taxonomy, analysis includes the C4 level while evaluation includes the C6 level. This shows that the test instrument used to measure student learning outcomes is still lacking because it only contains questions from the C1 to C4 levels.

There is an interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material
The results of hypothesis testing show that the Kruskal-Wallis H value or H_{count} is 25.004 so the value is greater than χ^2_{table} with df = 3, which is 7.815. The Asymp Sig. value obtained is 0.000 so the value is smaller than the significance level of 0.05. The results of this hypothesis test show that H_0 is rejected so that H_1 is accepted. The accepted H_1 shows that there is an interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material.

In the group of students with high critical thinking skills, the average learning outcomes of students using the mobile pocket book were 61.67 while those using the electronic book were 45.62. In the group of students' with low critical thinking skills, the average learning outcome of students' who

used the mobile pocket book was 52.98 while those who used the electronic book were 45.83. The average learning outcomes of knowledge showed the interaction of each group. This finding is consistent with previous research showing that learning media and critical thinking skills interact to influence knowledge-learning outcomes [29]. The selection of media to be used in learning activities must be adjusted to critical thinking skills and the material being studied because it will have an impact on the development of student knowledge so that it affects learning outcomes [30].

CONCLUSION AND SUGGESTION

Based on the results of the analysis and discussion, it can be concluded that: (1) there is a difference in the effect of using learning media mobile pocket book and electronic book on student knowledge learning outcomes, (2) there is no difference in the effect of critical thinking skills with high and low categories on student knowledge learning outcomes on Global Warming material, (3) there is an interaction between learning media mobile pocket book and electronic book with critical thinking skills on student knowledge learning outcomes on Global Warming material. Thus, mobile pocket books can be considered for use as learning media. In addition, it is necessary to assist students to improve critical thinking skills during the teaching and learning process to achieve the expected knowledge-learning outcomes.

REFERENCES

[1] Siagian, R. E. F. (2015). Pengaruh minat dan kebiasaan belajar siswa terhadap prestasi belajar matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *2*(2).

[2] Syafi'i, A., Marfiyanto, T., & Rodiyah, S. K. (2018). Studi tentang prestasi belajar siswa dalam berbagai aspek dan faktor yang mempengaruhi. *Jurnal komunikasi pendidikan*, *2*(2), 115-123.

[3] Putri, H., Susiani, D., Wandani, N. S., & Putri, F. A. (2022). Instrumen penilaian hasil pembelajaran kognitif pada tes uraian dan tes objektif. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *4*(2).

[4] Nofitasari, I., & Sihombing, Y. (2017). Deskripsi kesulitan belajar peserta didik dan faktor penyebabnya dalam memahami materi listrik dinamis kelas X SMA Negeri 2 Bengkayang. *Jurnal Penelitian Fisika Dan Aplikasinya (JPFA)*, *7*(1), 44-53.

[5] Maulani, M., Kurniawan, D. A., & Jumiarti, H. (2021). Identifikasi kemampuan analisis siswa dengan menerapkan model pembelajaran berpusat pada guru (Teacher Center Learning) pada mata pelajaran fisika di SMA N 1 Lubuk Sikaping. *SENRIABDI*, 143-150.

[6] Maryam, M., Kusmiyati, K., Merta, I. W., & Artayasa, I. P. (2020). Pengaruh model pembelajaran inkuiri terhadap keterampilan berpikir kritis siswa. *Jurnal Pijar Mipa*, *15*(3), 206-213.

[7] Fuad, A. J. (2020). Method of discussion and learning styles towards student's critical thinking ability. *Jurnal Penelitian Ilmu Pendidikan*, *13*(1), 1-9.

[8] Anita, Y., Thahir, A., Anita, K., & Rahmawati, N. D. (2021). Buku saku digital berbasis STEM: Pengembangan media pembelajaran terhadap kemampuan pemecahan masalah. *Mosharafa: Jurnal Pendidikan Matematika*, *10*(3), 401-412.

[9] Rohmaniyah, I. A., & Wiyatmo, Y. (2021). Pengembangan Media Pembelajaran Fisika Berbasis Augmented Reality pada Materi Pemanasan Global untuk Meningkatkan Hasil Belajar Peserta Didik Kelas XI SMA/MA. *Jurnal Pendidikan Fisika*, *8*(2).

[10] Wati, M., Misbah, M., & Rahmah, A. Pengaruh Penggunaan Media Pembelajaran Buku Saku Terhadap Hasil Belajar Siswa di SMA Negeri 2 Banjarmasin. In *Prosiding Seminar Nasional Tahun 2016 Mengubah Karya Akademik Menjadi Karya Bernilai Ekonomi Tinggi*. Program Studi Pendidikan Saints Pascasarjana Universitas Negeri Surabaya.

[11] Annisa, L., Oktaviana, C., & Habibi, A. A. (2020). Hubungan keterampilan berpikir kritis dengan hasil belajar peserta didik. *Edubiologica Jurnal Penelitian Ilmu Dan Pendidikan Biologi*, *8*(1), 35-37.

[12] Cohen, R. J., Swerdlik, M. E., & Phillips, S. M. (1996). *Psychological testing and assessment: An introduction to tests and measurement*. Mayfield Publishing Co.

[13] Suprapto, P. K., Hidayat, S., & Meylani, V. (2022). Pengaruh media pocket book terhadap hasil belajar peserta didik pada konsep Protista. *Bioma: Jurnal Ilmiah Biologi*, *11*(1), 10-22.

[14] Khumaidi, A., & Sucahyo, I. (2018). Pengembangan mobile pocket book fisika sebagai media pembelajaran berbasis android pada materi momentum dan impuls. *Inovasi Pendidikan Fisika*, *7*(2), 154-158.

[15] Kurniawati, I. D. (2018). Media pembelajaran berbasis multimedia interaktif untuk meningkatkan Pemahaman konsep mahasiswa. *DoubleClick: Journal of Computer and Information Technology*, *1*(2), 68-75.

[16] Wijoyo, A. (2018). Pengaruh Hasil Belajar Siswa dengan Menggunakan Multi Media Pembelajaran Interaktif untuk Sekolah Menengah Pertama dan Sekolah Menengah Atas. *Jurnal Informatika Universitas Pamulang*, *3*(1), 46-55.

[17] Wati, G. O. W., Ibrahim, M., Ghufron, S., & Mariati, P. (2021). Studi Komparasi Media Pembelajaran Gambar dan Video terhadap Hasil Belajar Mata Pelajaran IPA Pada Siswa di Sekolah Dasar. *Jurnal BASICEDU: Journal of Elementary Education*, *5*(5), 3364-3372.

[18] Khairani, M., Sutisna, S., & Suyanto, S. (2019). Studi meta-analisis pengaruh video pembelajaran terhadap hasil belajar peserta didik. *Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi dan Biologi*, *2*(1), 158-166.

[19] Pebriani, C. (2017). Pengaruh penggunaan media video terhadap motivasi dan hasil belajar kognitif pembelajaran IPA kelas V. *Jurnal Prima Edukasia*, *5*(1), 11-21.

[20] Anggraini, D., Suyatna, A., & Sesunan, F. (2017). Studi Perbandingan Hasil Belajar Fisika Antara Penggunaan Gambar Bergerak Dengan Gambar Statis. *Jurnal Pembelajaran Fisika*, *5*(1).

[21] Nurlaela, L. (2017). Pengaruh media pembelajaran dan motivasi belajar terhadap kemampuan berpikir kritis siswa. *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *1*(02).

[22] Choiroh, S. S., Prastowo, S. H. B., & Nuraini, L. (2022). Pengaruh Penggunaan E-LKPD Interaktif Berbantuan Live Worksheets terhadap Kemampuan Berpikir Kognitif HOTS Fisika Siswa SMA. *Jurnal Ilmiah Pendidikan Fisika*, *6*(3), 694-705.

[23] Suryaningsih, S., & Nurlita, R. (2021). pentingnya lembar kerja peserta didik elektronik (E-LKPD) inovatif dalam proses pembelajaran abad 21. *Jurnal Pendidikan Indonesia*, *2*(07), 1256-1268.

[24] Muthoharoh, M., Kirna, I. M., & ayu Indrawati, G. (2017). Penerapan lembar kerja peserta didik (LKPD) berbasis multimedia untuk meningkatkan motivasi dan hasil belajar kimia. *Jurnal Pendidikan Kimia Indonesia*, *1*(1), 13-22.

[25] Suarjana, I. M., Lasmawan, I. W., & Gunamantha, I. M. (2020). Pengembangan Instrumen Kemampuan Berpikir Kritis dan Sikap Peduli Lingkungan Tema 8 Pada Peserta Didik Kelas IV SD. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, *4*(2), 101-111.

[26] Wahyudi, E. E., Aminah, N. S., & Sukarmin, S. (2018). Pembelajaran optika geometri melalui problem based learning (PBL) ditinjau dari kemampuan berpikir kritis siswa dan kemampuan berpikir kreatif siswa sma kelas x tahun 2014/2015. *Inkuiri: Jurnal Pendidikan IPA*, *6*(3), 49-60.

[27] Nugraheni, D., Mulyani, S., & Ariani, S. R. D. (2013). Pengaruh pembelajaran bervisi dan berpendekatan SETS terhadap prestasi belajar ditinjau dari kemampuan berpikir kritis siswa kelas X SMAN 2 Sukoharjo pada materi minyak bumi tahun pelajaran 2011/2012. *Jurnal Pendidikan Kimia*, *2*(3), 34-41.

[28] Susilowati, Y., & Sumaji, S. (2021). Interseksi berpikir kritis dengan high order thinking skill (hots) berdasarkan taksonomi bloom. *JURNAL SILOGISME: Kajian Ilmu Matematika dan Pembelajarannya*, *5*(2), 62-71.

[29] Kunanti, E. S., Syarifah, S., & Sutopo, A. (2021). The Effect of Pop Up Book Learning Media and Critical Thinking on Results Students Learning IPS Class V Elementary School. *Sensei International Journal of Education and Linguistic*, *1*(2), 594-609.

[30] Fatahullah, M. M. (2016). Pengaruh media pembelajaran dan kemampuan berpikir kritis terhadap hasil belajar IPS. *Jurnal Pendidikan Dasar UNJ*, *7*(2), 237-252.