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THE VALIDITY OF STUDENT WORKSHEETS BASED ON PROBLEM-BASED LEARNING IN HUMAN BLOOD TYPE SYSTEM SUB MATERIALS TO TRAIN CRITICAL THINKING SKILL FOR SENIOR HIGH SCHOOL STUDENTS

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Abstract

Critical thinking skill is one of the competencies students must master to be able to confront the challenges of 21st-century education. The government seeks to compile the 2013 curriculum with learner-centered learning that is relevant to daily life. Learning that is relevant in daily life, one of which is the learning of Biology in the sub materials of Human Blood Type System. One alternative that can be used to facilitate students in developing their critical thinking skills is by providing them teaching materials forms students worksheets based on Problem Based Learning (PBL). This study aimed to produce PBL-based Students Worksheets to train students' critical thinking skills in the sub material of Human Blood type System based on the feasibility of presentation, content, and language. This study used the 4D model there were *define, design, develop, disseminate*. The stages carried out only up until the development stage. The validity of Students Worksheets was determined based on the results of the validation by three validators using the validation sheet instrument. Aspects of validity rated include aspects of presentation, content, language, worksheets characteristics to train critical thinking skills, and PBL-oriented worksheets characteristics. The results showed that the PBL-based worksheets in this study obtained a validity score of 3.95 with a very valid category. Based on the results of the validity, it can be concluded that the developed PBL-based worksheets in this study can be used in the teaching and learning process to train students' critical thinking skills.
Keywords: Validation, PBL-based worksheet, human blood type, critical thinking skills.

INTRODUCTION

Education in Indonesia is currently being confronted with the challenges of 21st-century education that requires students to be able to master all aspects of education. US-based Partnership for 21st Century Skills (P21), identifying the competencies needed in facing 21st-century challenges (which) are communication, collaboration, critical thinking, and creativity (Zubaidah, 2016; Greenstein, 2012). Therefore, critical thinking becomes an important competency to master. It is relevant to Government Regulation No. 17 of 2010 about the management and implementation of education that develops the foundation for the development of the students' potentials to become knowledgeable, capable, critical, creative, and innovative human beings. Facione (2013) divides critical thinking skills into six elements, including interpretation, analysis, evaluation, interference, explanation, and self-regulation.

In fact, the critical thinking skills of students in Indonesia is still relatively low. It can be seen from the results of the 2018 PISA survey. Indonesia is ranked 72 out of 79 countries (OECD, 2019). According to Sari et al. (2016) and Wasis (2015), this happened because students are still unable to use and develop critical and creative thinking skills, make decisions, and solve problems in solving PISA problems. Therefore, the government designed the 2013 curriculum in which learning is centered on students and relevant to daily life with the aims of training students' critical thinking skills.

One of the lessons that are relevant to the 2013 curriculum, according to Sudarisman (2015), is Biology learning in schools. It is relevant to the opinion of (Wahyudi et al., 2015), who states that Biology learning is not just mastering the knowledge, but also learning the discovery process based on the reality that exists in nature. One of the topics in Biology lessons related to daily life and can increase student's critical thinking in BC. 3.7 and 4.7, which requires analytical skills and studies about the case of human heredity, especially in the sub materials of the Human Blood Type System (Permendikbud No.24,

2018). Through the case study analysis activities, students can use and develop their critical thinking skills in solving the problems in the case studied.

Based on the preliminary study conducted at Muhammadiyah 1 Senior High School in Taman, it was shown that the questions were given by the teacher still do not bring up the students' critical thinking skills. Besides that, students tend to be confused accepting the concept of agglutination mechanism and rhesus system, it is because the learning presented is still in the form of one-way communication learning, so students are not optimal in receiving the learning and tend to feel bored. Therefore, an innovation using an appropriate learning model that can support students in developing their critical thinking skills is very much needed.

One of the learning models that are relevant to the 2013 curriculum, according to the Government Regulations on Education and Culture No.22 of 2016, is a problem-based learning model. According to the Ministry of Education and Culture (2013: 10b), learning with PBL models can bring up students' ideas in solving problems so that they can train critical thinking skills. Based on the results of research conducted by Saputra (2019), who developed PBL-based worksheets on environmental change material shows that it can train students' critical thinking skills. It is suitable for the results of research by Hanif et al. (2018), which suggests that the PBL model can improve student's critical thinking skills in the sub materials of the sense organs.

PBL-based learning, to be well implemented, requires teaching materials in the form of worksheets as a guide to the learning process. Student Worksheets are developed and designed according to the needs (Susantini et al., (2016); Anggraini et al., (2016)). According to Bakirei et al. (2011) and Umbaryati (2016), worksheets have the function of helping students learn in a directed, increasing the role of facilitators, increasing student activity, improving students' learning interest and helping to shape expected behavioral changes in students. Based on the description that has been describing, this study aimed to produce PBL-based worksheets in the sub materials of the Human Blood Type System to train students' critical thinking skills.

METHOD

This research is development research to produce student worksheets based on PBL, referred to as the 4D model proposed by Thiagarajan (1974). Two types of student's worksheet will be improved, including the teacher's worksheet. The 4D model consists of four stages, namely, Define, Design, Develop, Disseminate. The stages that were carried out only up until the development stage.

At the define stage included curriculum analysis (core competencies analysis and basic competencies analysis), student analysis, concept analysis, and assignment analysis. The design stage carried out in the preparation of student worksheets based on the PBL model in the sub materials of the Human Blood Type System, and the initial design of the worksheets. The development stage carried out by reviewing and revising the student worksheets and validated by three validators (lecturer in biology, lecturer in biology education, and biology teacher). Development and validation were carried out at the Department of Biology in Mathematics and Science Faculty of Surabaya State University in October 2019 - April 2020.

The data collection method used was the validation of worksheets by the three validators, namely education experts, material experts, and biology teacher at Muhammadiyah 1 Senior High School in Taman. The research instrument used was the worksheets validation sheet containing questions based on aspects of worksheets feasibility accompanied by an assessment rubric. The acquired data were analyzed by calculating the average score obtained from three validators, then interpreted based on Table 1, below.

Table 1. Interpretation Criteria of the worksheet validity

Average Score	Interpretation Criteria
3,26-4,00	Completely Valid
2,51-3,25	Valid
1,76-2,50	Quite Valid
1,00-1,75	Invalid

(Source: Riduwan, 2013)

RESULTS AND DISCUSSION

Profile of PBL-based worksheets in Humans Blood Type System sub material

This study aimed to produce PBL-based worksheets in the Sub materials of Human Blood Type System to train students' critical thinking skills that are valid and can be used in the learning process. There were two types of worksheets produced, including worksheets for students and for teachers, which were accompanied by answer keys for each question contained in worksheets. The aim of developing worksheets for teachers was to help and facilitate the teachers in implementing and using worksheets in the learning process without the assistance of the researchers. The two worksheets were distinguished through the worksheets cover page, as in the worksheets for teachers is titled “For Teachers”. It is showed in Figure 1.

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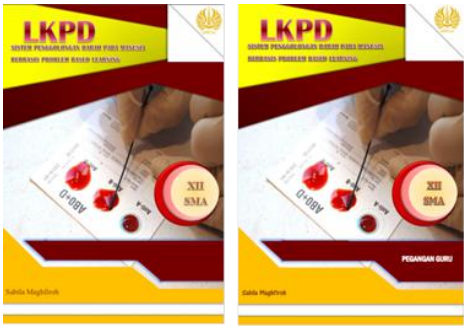

Figure 1. Display of worksheets developed.

PBL-based Worksheets were developed into two different topics, including Worksheets 1 is about the types of human blood type systems based on the concept of agglutination, while Worksheets 2 is about the types of human blood type systems based on the concept of the crossing. It is relevant to the opinion of Syakrina (2012), who states that one basic competency can be broken down into two worksheets titles. The colors of the two worksheets are different. The first worksheets are dominant with purple and pink and the second worksheets are dominant with yellow and orange. The aim of the selection of those suitable colors to increase students' motivation to use the worksheets (Prastowo, 2015). It is showed in Figure 2.

(a) (b)

Figure 2. (a) Display the first worksheet and (b) Display the second worksheet

The worksheets aim to train critical thinking skills that will be achieved through the PBL model syntax. According to Arends (2012), the PBL model has five learning syntax, including 1) orientation to the problem, 2) organizing students to learn, 3) guiding individual or group investigations, 4) developing and producing work, 5) analyzing and evaluating the problem-solving process. Each PBL syntax in the worksheets trains the ability to think critically. PBL syntax and indicators of critical thinking trained are marked with pink icons and highlights for Worksheets 1 and yellow for Worksheets 2. Each syntax in the worksheet also contained critical thinking skill indicators consist of interpretation, analysis, explanation, inference, evaluation, and self-regulation (Facione, 2013). Overall the description is shown in Figure 3. and Figure 4 in the following.

Figure 3. Display of the first worksheet critical thinking indicators and PBL syntax.

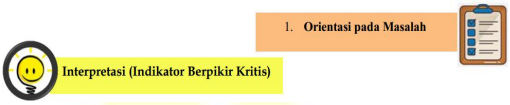

Figure 4. Second worksheet critical thinking indicators and PBL syntax Display.

Several other characteristics included in the two PBL-based worksheets were the components of let's read, come on read, flash news, and problem-solving activities. The Let's read component contained a problem related to the material and activities that will be carried out (**Figure 5**). The Come-on read component contained a summary of the material that can be used in the problem-solving process (**Figure 6**), and some questions that train the critical thinking skills were marked with parentheses (**Figure 7**). Then there was a flash news component that contained information used in carrying out problem-solving activities (**Figure 8**). The problem-solving activities consisted of the procedure of the activities, some discussion questions on the results of the activities, data analysis (**Figure 9**), and deciding the problem solving and concluding the results of the activities and the discussion activities (**Figure 10**).

(a) (b)

Figure 5. (a) Let's read components of the first worksheet and (b) Let's read components of the second worksheet.

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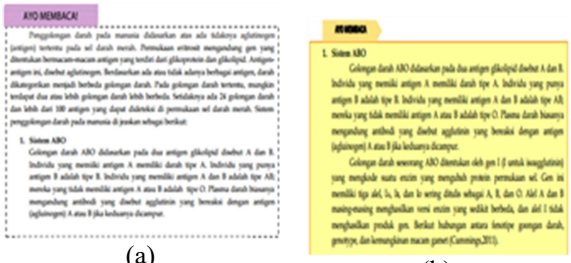
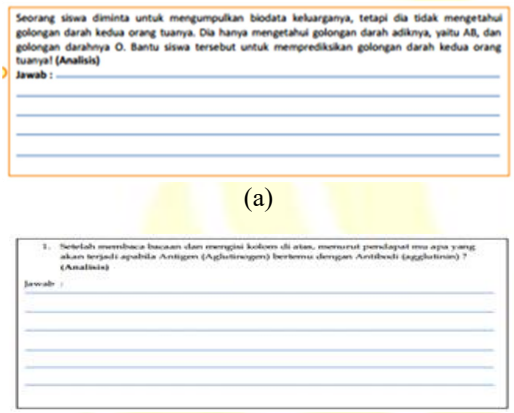


(a) (b)

Figure 6. (a) Come to read component of the first worksheet and (b) Come to read component of the second worksheet.



(a) (b)

Figure 7. (a) Critical thinking questions components of the first worksheet and (b) Critical thinking questions components of the second worksheet

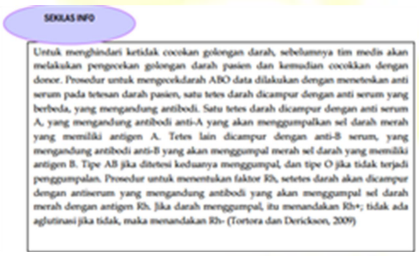
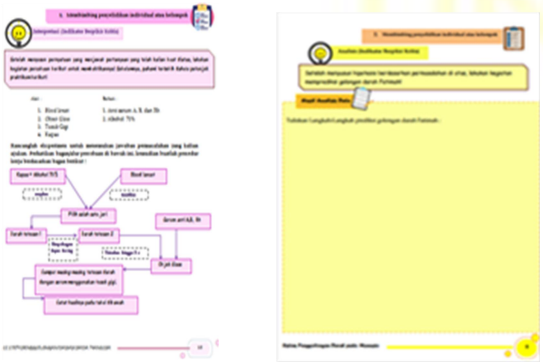
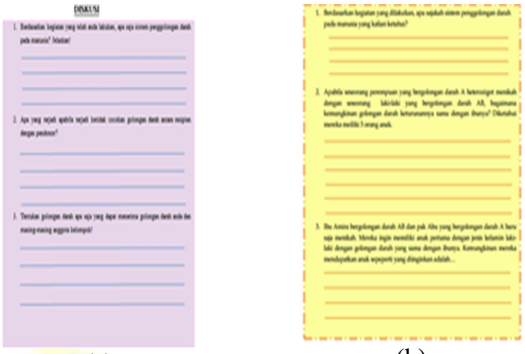


Figure 8. Flash News components.



(a) (b)

Figure 9. (a) Procedure of activities and data analysis of the first worksheet. (b) Procedure of activities and data analysis of the second worksheet.



(a) (b)

Figure 10. (a) Discussion component of the first worksheet and (b) Discussion component of the second worksheet.

The format of worksheets development is relevant to the opinion of the Ministry of National Education (2008) and Prastowo (2011), who state that the structure of the worksheets consists of six important components including, the title, subject matter, supporting information, tasks or activity steps, and assessment. The suitability of the worksheets development aimed to be able to achieve the worksheets objectives including helping students learn in a directed manner, so that it can be used to enhance the role of the facilitator and increase the activeness and learning interest of students through activities contained in the worksheets (Bakirei, 2011; Bicer, 2016; Noor , 2014).

The validity of PBL-based worksheet in Human Blood Type System sub material.

The developed Student Worksheets were validated by three validators consisting of educational expert lecturer, material expert lecturer, and Biology teachers to obtain recapitulation of worksheets validation data. The validity of the worksheets was assessed based on five aspects, including the feasibility of presentation, content, language, worksheets characteristics to train critical thinking skills, and PBL-oriented worksheets characteristics. Based on the analysis results from these aspects an average score of 3.95 was obtained with a very valid category (Riduwan, 2013). This showed that the developed worksheets meet the aspects that have been determined, so that the worksheets can be declared theoretically feasible and can be used in the learning process in the school. Following validity rating results of the PBL worksheet to train critical thinking skills in the

Submission human blood type system can be seen in Table 2 below.

Table 2. Results of validation Worksheets by three validators.

No	RATED ASPECT	Skor V1	Skor V2	Skor V3	Average	Category
A. Presentation						
1	Suitability of the cover with the topic	4	4	4	4	Very Valid
2	Inclusion of group identity	4	4	4	4	Very Valid
3	Inclusion of general instructions for activities	4	4	4	4	Very Valid
4	Inclusion of learning objectives	4	4	4	4	Very Valid
5	Overall presentation of the worksheet	4	4	4	4	Very Valid
	Average score of each aspect				**4,00**	Very Valid
B. Language						
1	Using Indonesian language according to PUEBI	4	4	3	3,67	Very Valid
2	The language used can be understood by students	4	4	4	4	Very Valid
	Average score of each aspect				**3,67**	Very Valid
C. Content						
1	Learning activities on the worksheets in accordance with the demands of the 2013 curriculum that can be a reference to carry out the task	4	4	4	4	Very Valid
2	The activities in the Worksheet support the basic competence	4	4	4	4	Very Valid
3	The material used is appropriate	4	4	4	4	Very Valid
4	Include the worksheet answer key	4	4	3	3,67	Very Valid
	Average score of each aspect				**3,83**	Very Valid
D. The characteristics of worksheet to train critical thinking skills						
1	The worksheets contain indicators of Interpretation ability	4	4	4	4	Very Valid
2	The worksheets contain indicators of Analytical ability	4	4	4	4	Very Valid
3	The worksheets contain indicators of Evaluation ability	4	4	4	4	Very Valid
4	The worksheets contain indicators of Inference ability	4	4	4	4	Very Valid
5	The worksheets contain indicators of Eksplanation ability	4	4	4	4	Sangat Valid
6	The worksheets contain indicators of self-regulation	4	4	4	4	Very Valid
	Average score of each aspect				**4,00**	Very Valid
E. Characteristics of PBL-oriented worksheets						
1	The worksheets guide students to make a problem determination	4	4	4	4	Very Valid
2	The worksheet guides students to learn	4	4	4	4	Very Valid
3	The worksheets guide students in the investigation	4	4	4	4	Very Valid
4	The worksheets require students to develop and produce work	4	4	4	4	Very Valid
5	The worksheet includes an evaluation of learning outcomes	4	4	4	4	Very Valid
	Average score of each aspect				**4,00**	Very Valid
	Average validation score of the worksheet				**3,95**	Very Valid

Information :
V1 : Validator 1 (Educational expert lecturer)
V2 : Validator 2 (Material expert lecturer)
V3 : Validator 3 (Biology teacher)

According to Depdiknas (2008) and Prastowo (2015), there are several important structures in student worksheets including the title, learning instructions, appropriate material, basic competencies to be achieved and accordance with government regulations, the existence of tasks and activities, writing and letters used, and the effectiveness of the image specified. The describe explained above are included in the aspect of the presentation and content. The feasibility of the presentation obtained a validation result with a maximum score of 4.00 with a very valid category. The feasibility of the contents obtained a validation result with a score of 3.83 with a very valid category.

Based on the validation results it can be inferred that the developed worksheet complies with the aspects of presentation and content feasibility. Because the development contents of the worksheet were appropriate with the opinion of the Ministry of National Education (2008) and Prastowo (2011), including analyzing the curriculum, compiling a map of needs, determining the title, paying attention to writing the contents of worksheets, also, the materials used were suitable with the competencies to be achieved. The basic competencies used in the worksheets are the BC 3.7 analyzing heredity patterns in human beings, and BC 4.7 presenting data on case study results on patterns of heredity in human beings in various aspects of life.

The feasibility aspects of the developed worksheets presentation are relevant to the Ministry of National Education (2008) and Prastowo (2015) who state that in

developing worksheet we must pay attention to the use of writing and letters, the effectiveness of image appearance, color matching and delivery of messages in figures in order to foster student learning motivation using the worksheets teaching materials.

Even so, it is necessary to improve the appearance of the worksheets cover for teachers, so that the developed worksheets can be used according to its function based on Umbaryati (2016) and Syakrina (2012), worksheets as a guide for educators and students in the learning process.

Validity scoring on the language aspect obtained a score of 3.67 with a very valid category. The acquisition of the score indicates that the developed PBL-based worksheets use Bahasa Indonesia in accordance with General Guidelines of Indonesian Spelling (Pedoman Umum Ejaan Bahasa Indonesia/PUEBI), the grammar used is in accordance with SPOK (Subject, Predicate, Object, Information), does not contain multiple meanings, and is in accordance with the level of students' development. It is in accordance with the Ministry of National Education (2008) and Prastowo (2011) who state that the language used must be in accordance with the level of maturity of students, and the sentence structure used in worksheets must be easily understood by students so that it does not cause multiple meanings to a statement.

Even so, there needs to be some improvement to foreign language phrases or words that should be italicized so that the developed worksheets are in accordance with the worksheets function according to Rosanti (2013) and Prastowo (2011), namely as teaching material that can facilitate students in understanding the lesson materials, make it easier for teachers to deliver the lesson materials, and help students in getting information and taking notes on concepts learned.

The average score from the aspect of the worksheet's characteristics to train critical thinking skills and PBL-oriented worksheets characteristics is 4.00 with a very valid category. This indicates that the activities and materials in LKPD are appropriate with the basic competencies to be achieved and the syntax of the PBL model (Sari et al., 2018; Prastowo, 2011). This is supported by PBL-based worksheets development research conducted by Khusnia (2018) and Maryam (2018) whose in the PBL-oriented worksheets aspect obtained a very valid category. It is because the developed worksheets already reflected the PBL syntax.

PBL model itself consists of five syntaxes according to Arends (2012), which include orientation to the problem, organizing students to learn, guiding individual and group investigations, developing and producing work, and analyzing and evaluating the problem-solving process. According to Wardani and Khan (2014), Marra et al. (2014), and Draghicesu et al. (2014) PBL model can develop high-level knowledge and skills such as critical thinking through problem-solving activities of a phenomenon that is relevant to everyday life. The critical thinking skills that are trained include interpretation, analysis, inference, explanation, evaluation, and self-regulation (Facione, 2013).

Interpretation skill is an activity to understand and express the meaning of a problem (Snyder, 2008; Facione, 2013; Nur, 2013). The interpretation skill in the developed worksheets was trained through the activities of formulating a question and statement that makes sense of a case about a blood transfusion error provided in the Come on Read component. It is also done through the activity of making work procedures based on the workflows. These activities are included in the PBL syntax, orientation to the problem, organizing students in learning, and guiding individual and group investigations.

The analytical skills are trained through analyzing data from problem-solving activities and answering questions based on the results of problem-solving activities and reading material summary activities on the Let's Read component. These activities are contained in the PBL syntax, guiding individual and group investigations. According to Facione (2013) and Nur (2013), analytical skills are an activity of identifying the relationship of information used in determining a decision.

The inference and explanation skills according to Facione (2013), Nur (2013), and Snyder (2008), is an activity of identifying results and information to get conclusions, and explanation is an activity of presenting decision results based on evidence obtained. These skills are trained through the activity of summarizing the results of activities and determining a solution to the problem of the blood transfusion case presented. These activities are contained through the PBL syntax, developing and producing works.

Meanwhile, the self-regulation skill is trained through discussion activities -answering questions related to all activities that have been carried out by students. According to Facione (2013) and Nur (2013), self-regulation skill is an awareness to monitor one's cognitive abilities, apply analytical skills, and evaluate themselves. The activity is contained through the syntax of analyzing and evaluating the results of problem-solving.

Based on the results of the validation by the three validators, assessed based on five aspects of assessment, it was found that the developed PBL-based worksheets to train critical thinking skills in the Sub materials of Human

Blood Type System was declared to be very valid and suitable for use in school learning.

CLOSING

Conclusion

Based on the results of the analysis and discussion, it can be concluded that the developed PBL-based worksheets to train critical thinking skills in the Sub materials of Human Blood type system declared valid based on the feasibility of presentation, content, and language with the acquisition of an average validation score of 3.95, which is classified in the category very valid and can be used in the learning process.

Suggestion

This development research was only carried out up until the validation stage. So there needs to be further implementation by conducting limited trials to find out how practical and effective it is when used in learning. This problem based model can also be used on other material that has investigation and practicum activities.

REFERENCE

Arends, R. I. 2012. *Learning to Teach Ninth Edition*. New York: The McGraw-Hill Companies.

Anggraini, R., Wahyuni, S., dan Lesmono, A. D. 2016. Pengembangan Lembar Kerja Siswa (LKS) Berbasis Keterampilan Proses di SMAN 4 Jember. Jember. Universitas Jember. Jurnal Pembelajaran Fisika, 4(4): 350–356

Bakirei, H., dkk. 2011.The Effects of simulation Technique and Worksheets on Formal Operational Stage in Science and Technology Lessons. Trabzon. Karadeniz Technical University.*Journal of Procedia Sosial and Behavioral Sciences,* 15 : 1462–1469

Bicer, N. 2016 .An Evaluation of Pre-Service Turkish Teachers' Skills and Knowledge Regarding Preparation of Worksheet to Teaching Turkish to Foreigners.Kills-Turkey.Kills 7 Aralik University.*Journal of Academic Educational Research and Reviews,* 11(5) : 164 – 173

Depdiknas. 2008. *Panduan Pengembangan Bahan Ajar*. Jakarta: Departemen Pendidikan Nasional.

Dokumen Kurikulum 2013. Kementrian Pendidikan dan Kebudayaan Republik Indonesia. 2018.

Draghicescu, L. M., Petrescu, A. M., Cristea, G. C., Gorghiu, L. M., Gorghiu, G. 2014. *Application of Problem Based Learning Strategy in Science Lessons – Examples of Good Practice. Targoviste. Valahia University Targoviste.* Journal Procedia – Social and Behavioral Sciences, 149 : 297 – 301

Facione P. A. 2013. *Critical Thinking: What It Is and Why It Counts*. Measured Reasons and the California Academic Press, Millbrae, CA

Greenstein, L. 2012. *Assessing 21st Century Skills:a guide to evaluating mastery and authentic learning*. London: Sage Publications Ltd.

Hanif, S. D., dkk. 2018. Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Problem Based Learning (PBL) Untuk Meningkatkan Keterampilan Berpikir Kritis pada Materi Virus Kelas X SMA. *Jurnal Online Mahasiswa (JOM) Bidang Keguruan dan Ilmu Pendidikan*, 5 (1) : 1-11

Kemendikbud. 2016. *Lampiran IV Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 10 B tahun 2013 Tentang Implementasi Kurikulum Pendoman Umum Pembelajaran.* Jakarta: Kementerian Pendidikan dan Kebudayaan.

Khusnia, Aida. 2018. Validitas Lembar Kerja Siswa Berbasis *Problem Based Learning* pada Materi Daur Ulang Limbah untuk Melatih Kemampuan Berpikir Kreatif Siswa Kelas X SMA. Vol 7 No.2, 2302-925

Marra, R., Jonassen, D. H., Palmer, B., dan Luft, S. (2014). Why Problem Based Learnig Works:Theoretical Foundations. *Journal On Excellence In College Teaching*. 25(3&3): 221-238.

Maryam, Anisa. 2018. Validitas Lembar Kegiatan Peserta Didik Berbasis *Problem Based Learning* pada Materi Sistem Peredaran Darah untuk Melatihkan Keterampilan Proses. Bioedu Vol 7No.2, 2302-925

Noor, Rasuane. 2014. Penyusunan Lembar Kerja Peserta Didik (LKPD) Biologi SMA Melalui Inventarisasi Tumbuhan yang Berpotensi atau Sebagai Pewarna Alami di Kota Metro. Metro, Lampung. Universitas Muhammadiyah Metro. Jurnal Bioedukasi, 5(2). ISSN : 2442-9805

Nur, M. 2013. Pendidikan dan latihan Pembelajarn Inovatif dan Pengembangan Perangkat Pembelajaran Bermuatan Keterampilan Berpikir dan Perilaku Karakter. Kerjasama Program studi Magister Pendidikan Biologi PPs Unlam dengan Pusat Sains dan Matematika Sekolah (PSMS) UNESA.

OECD. 2019. *PISA 2018 Result in Focus*. New York: Columbia University.

Pemerintah Republik Indonesia. 2010. Peraturan Pemerintah Republik Indonesia Nomor 17 Tahun 2010 tentang Pengelolaan dan Penyelenggaraan Pendidikan. Jakarta.

Permendikbud No. 24 Tahun 2016 Tentang Standar Proses Pendidikan Dasar dan Menengah.

Prastowo, A. 2011. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.

Prastowo, A. 2015. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Jogjakarta: DIVA Press.

Riduwan. 2013. *Dasar-dasar Statistika*. Bandung: Alfabeta.

Rosanti, Diana. 2013. Pengembangan Lembar Kerja Siswa Dengan Pendekatan Saintifik Untuk Memfasilitasi Kemampuan Problem Solving Siswa. Jurnal Pendidikan dan Pembelajaran UNTAN , h.3.

Saputra, S.A. 2019. Pengembangan LKPD Berbasis Problem Based Learning Pada Materi Perubahan Lingkungan untuk Melatihkan Keterampilan Berpikir Kritis. *Bioedu.Vol.8 No.2,* 2302-925.

Sari, P.S. dkk. 2017. Desain Instrumen Soal IPA Serupa PISA pada Sekolah Menengah Pertama. Prosiding Seminar Nasional Pendidikan IPA 2017 Universitas Sriwijaya. Conference.unsri.ac.id.[diakses pada tanggal 25 Februari 2020]

Sari, W. P., Sumarmin, R., dan Hilda, D. P. 2018. Validity of Biology Student Work Sheet Based on Problem Based Learning for Student Class XI. Padang. Universitas Negeri Padang. *International Journal of Progressive Sciences and High Technologies, 7 (1): 25-30*

Snyder, L.G dan Snyder, M.J. (2008). *Teaching Critical Thinking and Problem Solving Skills*. The Delta Epsilon Journal. *L* (2):90-99.

Sudarisman. S. 2015. Memahami Hakikat dan Karakteristik Pembelajaran Biologi dalam Upaya Menjawab Tantangan Abad Ke-21 Serta Optimalisasi Implementasi Kurikulum 2013. Jurnal Florea. Vol.02 No.01 : 29-39

Susantini, E., Isnawati, dan Lisdiana, L. 2016. *Effectiveness of Genetics Student Worksheet to Improve Creative Thinking Skills of Teacher Candidate Students.* Surabaya. State University of Surabaya. Journal of Science Education, 17(2): 74–79

Syakrina, N. 2012. Pengembangan Lembar Kegiatan Siswa Berbasis Masalah pada Materi Bangun Ruang Sisi Datar untuk Siswa Kelas VII SMP. Thesis. Yogyakarta: UNY.

Umbaryati. 2016. Pentingnya LKPD pada Pendekatan Scientific Pembelajaran Matematika. Bandar Lampung: Universitas Lampung.

Wahyudi, A., Marjono, Harlita. 2015. Pengaruh Problem Based Learning terhadap Keterampilan Proses Sains dan Hasil Belajar Biologi Siswa Kelas X SMA Negeri Jumapolo Tahun Pelajaran 2013/2014. Surakarta. Universitas Sebelas Maret. Jurnal Bio-Pendagogi, 4(1): 5-11 ISSN: 2252-6897

Wardani, F., and Khan, A. R. 2014. Problem Based Learning in Ophthalmology: A Brief Review. *Oman Journal of Ophthalmology,* 7(1)

Zubaidah, S. Keterampilan Abad Ke-21: Keterampilan yang diajarkan Melalui Pembelajaran. *Prosiding Seminar Nasional Pendidikan Biologi STKIP Persada Katulistiwa*. Kalimantan Barat.