The Need of Development of Problem-Based Learning Pocket Book on Science Content to Strengthen Science Process Skills

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ABSTRACT
Science learning based on the 2013 curriculum requires a fundamental change in the delivery process that can provide hands-on experience for students through object observation and assessment. Based on student data, student learning outcomes, specifically in science subjects' content are still low. Lack of development of science process skills affects student learning outcomes on science content. The needs analysis step was carried out using descriptive research method. The purpose of this research is to find deficiencies in the learning activities carried out by teachers so teaching support materials can be developed, namely problem-based pocketbooks to strengthen science process skills. Observation, interviews, questionnaires, and trial test were done to collect data. In this research, to analyze the data, the researchers used an interactive model, namely data reduction, data presentation, and drawing conclusions. Based on the problem, the fifth-grade teacher needs a teaching material or additional media to teach science that can strengthen the students' science process skills in developing new teaching materials in the form of a pocket book accompanied by a learning model that contains process skills. The development of pocket books can strengthen science process skills, together with problem-based learning models learning can become more active and curious. The problem-based learning model included in the pocketbook can strengthen students' science process skills through experimental activities.

Keywords: *Science, Problem Based Learning, Pocket Book*

1. INTRODUCTION

Science (*IPA*) learning activities based on the 2013 Curriculum require the school to make changes in the learning process that can give students hands-on experience through observation activities [1]. However, the implementation of delivering material that can provide hands-on experience for students in-class V of SDN Plosorejo 01 is less optimal. Teachers are still too guided by the rules of the teacher's book in delivering teaching materials. Teachers should assist students in developing scientific thinking through strategies and learning methods that will make them active [2]. The teacher makes improvements by instilling simple concepts and asking students to memorize the main points of the material being taught. However, the teacher's improvement efforts have not been able to overcome the problem of successful learning according to the 2013 Curriculum. It happened because students did not find the concept directly and were only given by the teacher so students were not able to find their own concept of the studied materials.

Learning science in grades V *KD 3.9* and *KD 4.9* on a pure and a mixture substance, teachers should create learning activities based on science process skills, so students get meaningful learning and have active learning. Science process skills are scientific skills that involve cognitive or intellectual and social skills that are used by students to obtain facts from a phenomenon around them. The ability of science process skills in the science learning process is very important because these skills can bridge hands-on experience through scientific research [3]. In fact, at SDN Plosorejo 01 the science process skills developed are still limited to observing activities. There are references in

developing science process skills, namely observing, measuring, and processing data [1]. These standards must be trained to start from elementary school students to the secondary level. One of the learning models that can improve science process skills is the Problem-Based Learning (PBL) model which can be a stimulator, a guide, and a strategy. In the PBL model, the entire learning process is centered on learners with a skills-focused approach. Process skills are skills that stimulate and develop facts and concepts as well as the growth and development of attitudes and values [4]. These skills need to be developed so students can understand the concepts in elaborating the material and be scientific in learning science. The aspect of instilling science process skills can be seen from several indicators. The indicator on the observing aspect is that students use the sense of sight to observe the environment. An indicator of the aspect of classifying is students are asked to classify information. In the aspect of teachers' and students' skills measuring tools must be involved. Likewise, by using prediction skills, students can predict the observations that have been done. In the aspect of concluding, students are given the opportunity to conclude even though it is not a conclusion from the results of experiments that have been carried out. In the aspect of communicating, students present information orally on the results that have been obtained from everyday experience [5].

This research develops a pocket book on the material of motion of objects for grade III elementary school [6]. The results of this research depict the feasibility of pocket books made based on the material expert assessment is 80%, media is 79%, and practitioners is 80%. The learning media developed also has good criteria in terms of the mean difference. The weakness in Murdianti's research is that it has not been able to significantly increase all the students' skills, there are only a few significant improvements in students' skill. Improving all students' skill require a long process. This pocket book cannot create meaningful learning.

Another research developed a mind mapping-based pocket book on science content with heat and transfer materials [7]. The results of this research depicted better changes in students' skills than previous ones. Students' skills and their understanding of science learning increase after using a mind mapping-based pocket book. The weakness of pocket book is the lack of various images and color variations that make them less attractive to students. Students tend to be interested in the shape or structure of mind mapping.

Based on the problems above, the researchers analyzed the problem of the low science process skills at SDN Plosorejo 01 as the basis for developing a pocket book under the title *"The Need of Development of a Problem-Based Learning Pocket Book on Science Content to Strengthen Science Process Skills"*. This research is very important for educators to develop a teaching media to strengthen process skills.

2. METHOD

This research is a need analysis using the descriptive research method. Observation, interviews, questionnaires, and trial tests were used to collect the data. Interviews were conducted with the respondents to find out more about the conditions of learning activities in the classroom. The interview is a follow-up to the observation. Observations were done to see the situation of learning activities in the classroom so the researchers could obtain data on the learning process carried out by respondents. Questionnaires given to teachers and students contain questions to obtain initial data from learning activities that occur in class V of SDN Plosorejo 01. The pretest is given to students to determine the level of mastery of a pure and a mixture substance. The subjects of this research were teachers and 15 students. To analyze the data, an interactive model was used, namely data reduction, data presentation, and drawing conclusions. Tables 1 and 2 present the questionnaires for teacher needs and student needs. The following is a grid of research needs questionnaires.

Table 1. *Questionnaire Grid of Teacher Needs*

No.	Indicator	Number of the Questions
1.	The condition of learning activities in class V	1, 2, and 3
2.	The condition of science learning	4 and 5
3.	Students' process skills and its constraints	6, 7, 8, 9, 10, and 11

4.	Teachers' skills in doing learning process in the class	12, 13, and 14
5.	Teachers' skills in using PBL model	15, 16, 17, 18, and 19
6.	Teachers' skills in using learning media	19, 20, 21, 22, 23, and 24
7.	Teachers' response on pocket book program	25 and 26

Table 2. *Questionnaire Grid of Teacher Needs*

No.	Indicator	Number of Question
1.	The condition of science learning with a pure and a mixture substance material	1, 2, 5, 6, 7, 8, and 9
2.	Constraints in science learning with a pure and a mixture substance material	3 and 4
3.	The hope of Problem-Based Learning (PBL) Pocket Book	11
4.	Profile of Problem-Based Learning (PBL) Pocket Book	
	a. display of pocket book	1, 2, 3, 4, 5, 6, and 7
	b. content of pocket book	8, 9, 10, and 11
	c. language	12, 13, and14
	d. presentation	15 and 16.

Table 3. *Grid of Pretest and Postest Questions*

Basic Competence	Indicator	Question Form	Domain	Number of Question
3.9 Grouping materials in everyday life based on their constituent components (a pure and a mixture substance)	3.9.1 Explaining the definition of a pure substance	Multiple choice	C2	2 and 5
	3.9.2 Exemplifying a pure substance	Multiple choice	C2	1, 3, 4, 7, 10, and 20
	3.9.3 Explaining the definition of a mixture substance	Multiple choice	C2	23 and 24
	3.9.4 Differentiating the mixture of homogen and heterogen	Multiple choice	C3	30, 31, 40, and 43
	3.9.5 Exemplifying the mixture	Multiple choice	C3	25, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, and 39
	3.9.6 Explaining the benefit of the	Multipl	C3	41, 42, and

mixture	e choice		44
3.9.7 Explaining the definition of the material	Multiple choice	C3	8 and 9
3.9.8 Classifying the material	Multiple choice	C3	6, 11, 12. 13, 14, 15,16, 17, 18, 19, 21, and 22
3.9.9 Explaining the types of mixture separation	Multiple choice	C2	45, 46, 49, and 50
3.9.10 Explaining the benefit of mixture separation	Multiple choice	C2	47 and 48

3. RESULT AND DISCUSSION

3.1. Research Result

3.1.1 Result of the Interview

Interviews were conducted with the fifth-grade teacher of SDN Plosorejo 01 with the following results.

The number of students in class V is 15 students, only some of them have average intelligence. The intelligence of students varies. The number of students who have high-level skills is 20%, the moderate level is 60% and the low-level skill is 20%.

The science process skills owned by students in the content of science subjects can be said to be quite low compared to the goals of science itself. It is because many science materials are in the form of theories that are difficult for students to understand so the implementation of science process skills is difficult to do due to the concept of material has not been mastered by students.

Teachers have difficulty in managing group work in class because there are still many students who keep talking with their friends and do not do their tasks. Some students draw randomly in notebooks and some of them are serious about working in a group so certain students can use their skills to complete the task. The fifth-grade teacher has tried to improve the learning and find the best solution by trying to make a group of smart and less smart (the result shows that only smart students do the task), playing experimental videos (the result shows many students focus on unimportant things, out of the experiment, such as clothes, pretty and handsome face, etc.).

The fifth-grade teacher has done problem-based learning, but only some students pay attention to learning. The methods used are questions and answers, discussions, demonstrations, and lectures. In using the problem-based learning model, learning becomes more active and students feel curious. By using notes, all students are interested in learning and solving a problem when using problem-solving models. Therefore, it is expected that all students actively participate in solving problem. But all students do not actively participate, some students are active, and some are passive because the character of each student is different. The problem-solving model can be applied in any subject and it can be adapted to the current material, especially in science material that is related to everyday life.

The teaching materials used by the teacher are teacher's books and students' thematic books. Students tend to feel bored when using the thematic book because the material in the student books is too shallow. The teacher has never used a pocket book in learning. The use of pocket book as additional support in learning, especially in science content, is expected to help students to understand the material easier. It is because there are various subjects in the thematic book so the students must first look for a certain material. The pocket book is expected to help students to go directly to the material. The criteria of the pocket book that the fifth-grade teacher wants are having lots of interesting pictures for elementary school students, containing meaningful reading, concise, and full-colored to make it more interesting.

From the results of the interviews, it can be concluded that most students find it difficult because a lot of materials used are in the form of theories and teaching methods used by teachers are questions and answers, discussions, demonstrations, and lectures. When using the problem-solving model, it is expected that all students are actively involved in problem-solving. But some students are active, and others are passive because the character of each student is different. Teachers still rarely use teaching aids to support learning. They only use teacher and student books in teaching.

3.1.2. Result of the Questionnaire

The questionnaire of teacher needs was given to the fifth-grade teacher of SDN Plosorejo 01 to seek certainty about the need to develop a problem-based learning pocket book. The teacher filled out a questionnaire that had been prepared by the researchers so the researchers can find ideas that need to be developed in the pocket book. Based on the questionnaire, the fifth-grade teacher of SDN Plosorejo 01 has carried out a pure substance material in science learning according to the nature of science and the model used can improve the students' skills in the science process. It has problems because students have difficulty in instilling the concept, so the teachers need companion books (additional textbooks) for students to understand a pure and a mixture substance material that is flexible and concise and includes all the material needed by students.

Questionnaires of student needs were given to find out the conditions of learning that had been experienced, both in terms of learning models, teaching materials, and skills development carried out by class V teachers of SDN Plosorejo 01. Questionnaires of student needs are also used to determine the specifics of developing PBL pocket books. Based on the results of the questionnaire filled out by students, there are still many students who have difficulty in understanding science material, that is 9 students who answered that they found it difficult. 15 students responded that they need additional science textbooks that interest them and can be carried or is flexible. So, it can be said that the fifth-grade students of SDN Plosorejo 01 need a companion textbook that can help them to understand science material easier.

The results of the questionnaire of teachers' and students' needs include the specifications of the pocket book. The results of the questionnaire will become the basis of the development of a PBL-based pocket book. The summary of the results of the specifications can be seen in Table 4.

Table 4. *Pocket Book Specification*

No.	Spesification	Questionnaire Conclusion
1	Shape	Rectangular
2	Size	14,8 x 10,5 cm (A6)
3	Length	15–25 pages
4	Paper color	White
5	Book color	Colorful
6	Language	Indonesian standard
7	Type of Question	Essay
8	Font	Calibri/ easy to read

3.1.3. Result of Pretest

Mastery of the students' material in this research was obtained from the trial test. The results of the testing analysis will be used as guidance for developing material on a pocket book based on problem-based learning. In the trial test, there are also process skills to solve problems so the researchers can analyze what process skills need to be developed in making problem-based learning-based pocket books. The results of the first stage of the trial test can be seen in Table 5.

Table 5. Material Mastery Mapping

Number of Question	Material	Process Skill	Number of Student's Error
1	The basic concept of a pure substance	Observing	12
2	The example of a pure substance	Classifying	13
3	The example of a pure substance	Drawing conclusion	14
4	The characteristic of a pure substance	Drawing conclusion	13
5	A pure substance compound	Classifying	9
8	A homogeneous mixture and a heterogeneous mixture		9
10	Type of a pure substance	Classifying	8
11	The definition of an element		12
12	The definition of a compound		9
14	An element symbol		11
17	Type of an element	Classifying	9
18	An element symbol		9
19	The example of a compound	Classifying	8
23	The characteristic of a pure substance		10
24	Mixture of substance	Predicting	8
25	Mixture of substance	Observing/Predicting	10
26	Mixture of substance	Observing /Predicting	10
27	Types of substance	Classifying	7
30	Mixture of substance	Observing/Classifying	9
31	Mixture of substance		8
35	Types of substance	Classifying	8
36	Types of substance	Classifying	10
38	Types of substance	Classifying	7
40	Mixture change	Predicting	7
41	The example of mixture	Drawing conclusion	9
43	Mixture difference	Observing	8
45	Separation substance technique	Drawing conclusion	9
46	Separation substance technique		7
47	Separation substance technique	Drawing conclusion	10
48	Separation substance technique		9

The results of the first phase of the trial are shown in Table 6. The focus of the material is on developing a pocket book that is adjusted to the material that has not been mastered by students in which there are 7 to 15 students who still make mistakes in doing the test. The process skills contained in the questions also become the focus of development in the pocket book. There are still science process skills that students have not

mastered according to the results of the first phase of the trial. Meanwhile, there is only 1 student who completed the trial test and passed the KKM, 14 students have not completed it, and some students are still far from the KKM.

Table 6. Result of Students' Pretest

Students' Number	Incorrect	Correct	Score
1	34	16	32
2	37	13	26
3	32	18	36
4	24	26	52
5	21	29	58
6	20	30	60
7	23	27	54
8	11	39	78
9	29	21	42
10	28	22	44
11	19	31	62
12	31	19	38
13	22	28	56
14	27	23	46
15	19	31	62

3.2. Discussion

Based on the daily test data of the fifth-grade students of SDN Plosorejo 01, the student's learning outcomes, specifically in the science content, are still low. Based on the *KKM* that has been determined, the content of science subjects has a minimum completeness criterion of 75. In Table 6 only 1 student has passed the *KKM*. According to the Ministry of National Education, learning is stated to be complete if it has reached 75% [8]. In addition, from the interview, the teacher said that science was one of the subjects that were pursued to achieve maximum grades. Table 5 and Table 6 show the results of mapping mastery of the material. There are still many students who have not mastered the material and process skills, namely observing, classifying, predicting, and concluding. It is indicated by the number of incorrect answers from students that cause only 1 student can pass the KKM. The lack of development of science process skills affects student learning outcomes on science content [3].

Another factor that affects the students' low science process skills is the unavailability of supporting teaching materials other than teacher's books and student's books. In learning, teachers often use teacher books and student books as references and the teacher lacks the effort to use other references in learning. In using these teaching materials, the learning activities do not run effectively because students feel bored and less interested. Teacher's books and student's books are used by the teachers as guidance and they do not want to try new things in learning activities or use new learning resources that support the improvement of students' scientific process skills in science content [9].

The last factor that affects the low level of science process skills is the discrepancy of the teacher's teaching model. The teaching model applied by the teacher is only guided by the teacher's handbook so learning variations are not applied by the teacher. The selection of learning models that are not suitable for teaching materials will affect the students' skills [10]. The learning model must be following *KD 3.9* and *KD 4.9*, that is creating activities to use the area around the school so students can experiment with a pure and a mixture substance materials, can apply to learn oriented to higher-order thinking, and pack it up in a fun learning strategy or method by bringing students to real situations or bringing concrete objects [11]. The making of this activity will stimulate student learning. When students learn social interaction and personal thinking through active seeking, teachers can learn actively and construct through experience because this process allow them to acquire knowledge [12]. Based on the problems

above, it is necessary to make improvements that can enhance the quality of science learning.

The solution to the problems at SDN Plosorejo 01 is the need to develop a new teaching material accompanied by a problem-based learning model that can strengthen process skills. Based on the research data obtained, the development of a pocket book will fully contain the problems that are often seen or experienced by students. These problems will be used as a stimulus to increase students' curiosity. The problems are given, of course, must follow the stages of the problem-based learning model in order to achieve the expected learning objectives. Problem-Based Learning (PBL) is a way of teaching and creating courses using problems as a stimulator and focus of student learning activities [13]. The problems presented in the PBL-based pocket book in this research are problems that happened in the surrounding environment and are related to everyday life. Basically, science material is related to the surrounding environment. The PBL learning model can increase students' creativity because it is started by exploring the surrounding environment to identify problems and find solutions [14] so in problem-solving students can actively participate and think critically in science learning. Critical thinking is reasonable and reflective thinking that focused on deciding what to believe and what to do [15]. It means when students think critically, they will be able to decide exactly what to believe and what to do. The implementation of the PBL model can increase the activeness of students until they reach the active criteria and students' scientific analysis skills continue to increase until they reach indicators of success [16].

The provision of a pure and a mixture substance material will be adjusted to the nature of science, namely science as a product, science as a process, and science as an attitude. The three natures of science will be implemented in the form of experiments conducted by students in completing the tasks in the pocket book to strengthen students' science process skills. The nature of science as a process describes that science is a discovery process for compiling knowledge which includes observations, experiments, conclusions, and others. The nature of science as a product gives results in the form of facts which are the basic products of science. Besides facts, the products of science are also in the form of concepts, principles, and laws. Science products are obtained from the results of intensive and continuous research. Science as an attitude is formed by a way of thinking to solve a problem through scientific activities. Scientific attitudes include curiosity, critical, objective, and open attitude. This scientific attitude will accompany the search for facts, concepts, laws, principles, and theories in science [17]. Science is a body of knowledge consisting of a collection of facts, concepts, theories, and laws discovered through the scientific process. Science is an attitude and involves a way of thinking. One of the reasons that science is included in the elementary school curriculum is that science is the basic knowledge of technology. It is hoped that in the future, by providing science materials in elementary schools, this nation will master technology [18].

The specifications of the pocket book that will be developed are following the problems for strengthening science process skills. It is a rectangular pocket book and size of 14.8 cm x 10.5 cm (A6). The number of pages for each chapter is 15-20 pages and the paper used is white with colored items. The language used is in the form of standard Indonesian and the trial test is using Calibri letters that are easy to read. The PBL-based pocket book is designed concisely, contains the main materials presented and displayed by containing the problems that exist in the environment around students and they must solve existing problems. Students will be encouraged to think critically and present their concepts through the following steps; 1) Orientation of students to existing problems; 2) Organizing students to be ready to learn; 3) Guiding students to conduct investigations individually or in groups; 4) Developing and presenting the students' work; 5) Analyzing and evaluating the problem-solving process [15]. This PBL-based pocket book is attractively designed with full of colors and pictures that students like so they do not get bored easily. The paper used for making this PBL-based pocket book is Ivory paper for the content and cover to not be easily damaged. The development of a pocket book is following the opinion [19] which states that a pocket book is a small book that contains writing and pictures in the form of explanations that will guide and provide instructions regarding knowledge and are easy to carry everywhere. Pocket books can improve the students' skills in the moderate level category and have practicality in their use during learning activities [7]. This statement becomes the basis for the researchers to state that a pocket book has a practical value that improves the science process skills can be achieved. The development of a pocket book combined with a problem-based learning model will strengthen students' scientific process skills through the curiosity stimulated by using the problem-based learning model. In learning science, elementary school-aged students ranging from 6 or 7 years to 11 or 12 years are included in the category of the real operational phase in which this phase shows the curiosity of students who are high enough to recognize their environment [20]. Thus, the use of pocket books based on problem-based fits the characteristics of students because in pocket books based on problem-based learning students are trained to think critically and grow their curiosity about the surrounding environment to find the concepts of the material they are studying. Funk stated in detail about the strengthening of science process skills that is

divided into two levels, namely (1) basic process skills (observation, classification, communication, measurement, prediction, and inference) and (2) integrated process skills (determining variables, processing data, analyzing investigations, formulating hypotheses, determining variables operationally, planning investigations, and conducting experiments) [21]. A pocket book based on problem-based learning will pay attention to basic and integrated process skills packed in the form of simple experiments.

4. CONCLUSION

Strengthening process skills can be done through the development of a pocket book based on problem-based learning by accomodating problems from events that are often seen or experienced by students. These problems will be used to stimulate the improvement of students' curiosity. The development of a pocket book will be adapted to the nature of science, namely science as a product, science as a process, and science as an attitude. The three natures of science will be realized in the form of experiments carried out by students to complete the tasks in the pocket book to maximize students' scientific process skills. Thus, the pocket book based problem-solving is designed attractively with full of colors and pictures that are liked by the children so that students do not get bored easily. The use of problem-based learning models can improve students' science process skills.

WRITER CONTRIBUTION

Author 1 as the author of the article and author 2 as a supervisor and reviewer of the article.

ACKNOWLEDGMENT

The researchers would like to thank Mrs. Ika Candra Sayekti as the supervisor, Elementary School Plosorejo 01 for permitting this research, and Muhammadiyah University of Surakarta for organizing this program.

REFERENCES

[1] R. Rahayu and E. W. L. FX, *Pengembangan Perangkat Pembelajaran IPA Berbasis Problem Based Learning Di SMP*, *J. Kependidikan Penelit. Inov. Pembelajaran*, vol. 45, no. 1, p. 125247, 2015, doi: 10.21831/jk.v45i1.7184.

[2] M. Liliasari, *Model Pembelajaran IPA untuk Meningkatkan Keterampilan Berpikir Tingkat Tinggi Calon Guru sebagai Kecenderungan Baru pada Era Globalisasi*, *J. Pengajaran Mat. dan Ilmu Pengetah. Alam*, vol. 2, no. 1, p. 54, 2015, doi: 10.18269/jpmipa.v2i1.392.

[3] W. E. Y. Rofiqoh and N. K. T. Marturtuti, *Pengaruh Praktikum Jamur Berbasis Keterampilan Proses Sains terhadap Hasil Belajar Biologi Materi Jamur*, *J. Biol. Educ.*, vol. 4, no. 1, pp. 9–15, 2015, doi: 10.15294/jbe.v4i1.5185.

[4] A. Desstya, *Keterampilan Proses Sains dan Pembelajaran IPA di Sekolah Dasar (Telaah Buku Siswa Kelas IV SD Tema 2 Karya Sumini)*, *Profesi Pendidik. Dasar*, vol. 2, no. 2, pp. 95–102, 2015.

[5] I. C. Sayekti and A. M. Kinasih, *Kemampuan Guru Menerapkan Keterampilan Proses Sains dalam Pembelajaran IPA pada Siswa Kelas IV B SDN14 Surakarta*, *Profesi Pendidik. Dasar*, vol. 1, no. 1, p. 93, 2018, doi: 10.23917/ppd.v1i1.4464.

[6] D. Murdianti, *Pengembangan Media Pembelajaran Buku Saku Materi Gerak Benda Mata Pelajaran IPA Kelas III SDN 1 Kemloko Grobogan*, 2017, [Online]. Available: https://lib.unnes.ac.id/30089/.

[7] M. Mashita and K. Komalasari, *Efektivitas Penggunaan Media Buku Saku dalam Pembelajaran Pendidikan Kewarganegaraan untuk Menumbuhkan Cinta Budaya Daerah Siswa (Studi Kuasi Eksperimen pada Siswa Kelas VII SMP Negeri 5 Malang) Effectiveness Of Using Media Pocket To Raise Culture Love Re*, *Model. J. Progr. Stud. PGMI*, vol. 3, no. 1, 2016.

[8] Ahmad Susanto, *Teori Belajar & Pembelajaran di Sekolah Dasar*. Jakarta: Kencana, 2012.

[9] R. U. Octavia, P*engembangan Buku Teks Kelas V Sekolah Dasar Berbasis Tematik dengan Model Multiple Games*, *J. Rev. Pendidik. Dasar J. Kaji. Pendidik. dan Has. Penelit.*, vol. 2, no. 2, p. 184, 2016, doi: 10.26740/jrpd.v2n2.p184-194.

[10] W. Wirda, A. Gani, and I. Khaldun, *Penerapan Pembelajaran Model Problem Based Learning (PBL) untuk Meningkatkan Keterampilan Proses Sains dan Motivasi Belajar Siswa pada Materi Alat-alat Optik*, *J. Pendidik. Sains Indones.*, vol. 3, no. 2, pp. 131–142, 2015.

[11] D. Afriki, *IPA dan Pembelajaran Berpikir Tingkat Tinggi*, *MUALLIMUNA J. Madrasah Ibtidaiyah*, vol. 2, no. 1, pp. 259–266, 2016.

[12] M. Karami, I. Z. Karami, and M. Attaran, *Integrating Problem Based Learning with ICT for Developing Trainee Teacher's Content Knowledge and Teaching Skill Mehdi Karami Shahid Madani University , Tabriz , Iran Zohreh Karami Mohammad Attaran University of Malaya , Kuala Lumpur, Malaysia*, *Int. J. Educ. Dev. using Inf. Commun. Technol. (IJEDICT)*, vol. 9, no. 1, pp. 36–49, 2013.

[13] H. S. S. Hera, *The Problem Based Learning (PBL)-Based Entrepreneurship Learning Model*

Development to Improve the Life Skills of the Teacher Training Students in Private Universities throughout Solo Raya, *Int. J. Educ.*, vol. 1, 2013.

[14] S.Fatimah, *Devoting to Enchance The Critical Thinking Skill and The Creativity of Students in Sevent Grade Through PBL Model With Jas Approachment*, *J. Pendidik. IPA Indones.*, vol. 4, no. 2, pp. 97–195, 2015.

[15] Y. N. Nafiah, *Penerapan Model Problem-Based Learning untuk Meningkatkan Keterampilan Berpikir Kritis dan Hasil Belajar Siswa*," *J. Pendidik. Vokasi*, vol. 4, no. 1, 2014.

[16] D. Dewantara, *Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Aktivitas dan Hasil Belajar Siswa pada Pelajaran IPA (Studi pada Siswa Kelas V SDN Pengambangan 6 Banjarmasin)*, *J. Paradig.*, vol. 11, no. 2, pp. 41–44, 2016.

[17] I. C. Sayekti and A. Desstya, *Pembelajaran IPA Sekolah Dasar*. Surakarta: Muhammadiyah University Perss, 2020.

[18] A. Desstya, I. I. Novitasari, A. F. Razak, and K. S. Sudrajat, *"Model Pendidikan Paulo Freire, Refleksi Pendidikan IPA SD di Indonesia (Relevansi Model Pendidikan Paulo Freire dengan Pendidikan IPA di Sekolah Dasar)*, *Profesi Pendidik. Dasar*, vol. 1, no. 1, p. 1, 2018, doi: 10.23917/ppd.v1i1.2745.

[19] R. Meikahani and E. S. Kriswanto, P*engembangan Buku Saku Pengenalan Pertolongan dan Perawatan Cedera Olahraga untuk Siswa Sekolah Menengah Pertama*, *J. Pendidik. Jasm. Indones.*, vol. 11, no. 1, pp. 15–22, 2015.

[20] R. E. Slavin, *Educational Psychology theory and Practice*. Massachusetts: Paramount, 1994.

[21] Dimyati and Mudjiono, *Belajar dan Pembelajaran*. Jakarta: PT Bumi Aksara, 2009.