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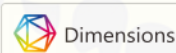*Nationally Accredited by DIKTI*

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Jurnal Pendidikan Fisika Indonesia

Jurnal Pendidikan Fisika Indonesia [p-ISSN 1693-1246 | e-ISSN 2355-3812] is a peer-reviewed journal published two times a year (January and July) by Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang. Jurnal Pendidikan Fisika Indonesia is an integrated forum for communicating scientific advances in the field of physics and education physics. The journal reports significant new findings related to physics and education physics, including: learning media development, learning methods development, learning methods implementation and several application of physics.

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This Journal is firstly published in 2003 and periodically published twice per year. Since 2011 it is accredited with quality level achievement of B by Directorate General of Higher Education, Ministry of Education and Culture, Republic of Indonesia No. 81/DIKTI/Kep./2011 , Ministry of Research, Technology, and Higher Education, Republic Indonesia with Second Grade (Peringkat 2, Sinta 2) since year 2016 to 2020 according to the decree No. 21/E/KPT/2018 & Ministry of Research and Technology/National Agency for Research and Innovation 2020-2024, Number 148/M/KPT/2020

Jurnal Pendidikan Fisika Indonesia is indexed in Emerging Sources Citation Index (Clarivate Analytics), Directory of Open Access Journals, Google Scholar, GARUDA, Crossref DOI, EBSCO Open Science Directory, SINTA 2

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Jurnal Pendidikan Fisika Indonesia

E-ISSN: 23553812

Penerbit: Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang Ditetapkan sebagai Jurnal Ilmiah

TERAKREDITASI PERINGKAT 2

Akreditasi Berlaku selama 5 (lima) Tahun, yaitu Volume 16 Nomor 1 Tahun 2020 sampai Volume 20 Nomor 2 Tahun 2024

Jakarta, 03 Agustus 2020 Menteri Riset dan Teknologi/ Kepala Badan Riset dan Inovasi Nasional Republik Indonesia,

Bambang P. S. Brodjonegoro

DEVELOPING SCIENCE LEARNING INSTRUMENTS BASED ON LOCAL WISDOM TO IMPROVE STUDENT'S CRITICAL THINKING SKILLS

PENGEMBANGAN PERANGKAT PEMBELAJARAN IPA BERBASIS KEARIFAN LOKAL UNTUK MENINGKATKAN KEMAMPUAN BERPIKIR KRITIS SISWA

S. Wahyuni

Physics Education Program, Faculty of Mathematics and Science Universitas Jember, Indonesia

ABSTRAK

Penelitian ini bertujuan mengembangkan perangkat pembelajaran IPA yang berupa Buku ajar, LKS, Silabus, dan RPP berbasis kearifan lokal untuk meningkatkan kemampuan berpikir kritis siswa SMP. Indikator kemampuan berpikir kritis siswa mencakup interprestasi, analisis, evaluasi dan inferensi. Penelitian ini merupakan penelitian Research and Development dengan metode Analysis, Desaign, Development, Implimentation and Evaluastion (ADDIE). Validasi ahli dilakukan dengan uji expert terkait dengan format, isi/materi, dan bahasa. Instrumen yang digunakan dalam pengambilan data adalah dokumentasi, lembar validasi, lembar observasi, dan tes. Hasil ujicoba instrumen di kelas VII SMP Bustanul ulum Panti Kabupaten Jember menunjukkan adanya peningkatan kemampuan berpikir kritis siswa, baik yang diambil dari teknik tes maupun observasi. Berdasarkan indikator kemampuan berpikir kritis diperoleh nilai rata-rata N gain 0,47 dengan interpretasi sedang. Simpulan penelitian ini menunjukkan perangkat pembelajaran IPA berbasis kearifan lokal yang dikembangkan dalam katagori valid sehingga cukup efektif dalam meningkatkan kemampuan berpikir kritis siswa.

ABSTRACT

This research aims to develop learning instruments of science i.e. textbook, student worksheet, syllabus, and lesson plan based on local wisdom that can improve critical thinking skills of junior high school students. Indicators of student's critical thinking skills include interpretation, analysis, evaluation and inference. This study is a Research and Development by using analysis, desaign, development, implementation and evaluation (ADDIE) method. Expert validation was conducted with the expert test related to the format, content/material, and language. The instruments ware used on the collection data are documentations, validation sheets, observation sheets, and tests. The result of the instrument in the 7th grade of junior high school at Bustanul Ulum Panti Jember showed that there are the improvement of critical thinking skills of student based on the data from test and observation. According to indicator of critical thinking skills, the n-gain value is around 0.47, means moderate interpretation. The conclusions of this research are the learning instruments of science based on local wisdom which develope in the valid category is quite effective to improve students' critical thinking skills.

INTRODUCTION

The related policy about inserting local wisdom program in the standard of a curriculum and underlied the reality that Indonesia has cultural diversity. So the content standard in implementation of Kurikulum Tingkat Satuan endidikan (KTSP) stated that science learning

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in junior high school must refer to the local wisdom of each area (Ridwan, 2007). It is because the local wisdom is the basic standard to take a policy on the local level of health, agriculture, education, natural resource management and society activity (Tiezzi *et al.* 2007).

But in fact many young generations don't know about local wisdom in their area. Even though local wisdom is contains of cultural local wisdom also. Cultural local wisdom is local knowledge that has fused with belief, norm, culture, and be expressed in the tradition and myth which embracced in long term time (Rusilowati *et al.* 2012). Thus, each teaching lesson material needs to integrate environment and local wisdom, so it can hold local wisdom and keep environment. Through the understanding on local wisdom, the harmony relation between human and environment can be peserved.

Based on the result of observation, it shows that all schools that have been observed haven't done KTSP demand well. The teacher still use learning instruments composed by government (Ministry of education) that actually those are only sample. Many science teachers still dependent on classical way in teaching where the teacher is only learning source (teacher centered*)*. The students are not introduced about the nature of science holistically. So the students only memorize concept without improving critical thinking skills on solving the problems around them. The nature of learn science was not enough to only memorizing and understanding scientists' invention. Problem solving is the main aim of learning science (Korsunsky, 2004). Thus it is needed to conduct a development of learning instruments that can introduce and instruct the student's skills on the nature of learning science.

The problem solving of those problems is through developing natural science learning instruments based on local wisdom. These learning instruments also adapted with the condition of students around. The expectation is to help science teachers to teach their students. Another results expected from developing these learning instruments is to improve students critical thinking skills.

There are some basic standards to develop science learning process i.e observe, measure, experiment and processing data (Hodosyova, 2015). Those stndards must be trained begin from students of primary school until secondary school. As supporting science learning activity, it is needed the thinking skill in science process. Deta *et al.* (2013) stated that

there was interaction among learning method, creativity and student's science process skills. Based on that statement it is needed to make science learning process activity to improve thinking skills.

Thus thinking skills are needed in science learning. One of them is critical thinking skills (Budiman *et al.* 2008). The limitation of Indonesian student's critical thinking skills caused the result of science literacy conducted by TIMSS was in place 40 from 42 countries (TIMSS & PIRLS International Study Center, 2012). This reality is supported by the limitation of the implementation of science learning that cannot give contextual phenomena in science learning. The instructional model is teacher centered. The one way activity was dominant in learning activity so the students are inclined passive and there was not thinking process well.

To solve those problems, the learning processes in the school hopefuly train the students to think. Teaching critical thinking is important because through critical thinking, the students will be trained to observe, make questions, make hyphotheses, make observation and collect data, then give the conclusions. Ciritcal thinking also trains the students to think logically and don't accept something easily. According to Staib (2003) critical thinking skills were important to help students to develop their talent, train to concentrate and focus on problems and think analytically.

Critical thinking skills depended to the exercises had been often done (Dwyer *et al.* 2012). That reality was seen in the school, it showed that on learning science, the students were still based on theory only and less of improving critical thinking skills. Student's enthuastic in answering the question were still theoretical and have not showed their talent. Besides that, there were still some students who difficult working in a group, communication, solve the real problem, and could not take decision as suitable solution on the problems.

Based on background and identifying the problems above, so the objective of this research is developing science learning instruments based on local wisdom to improve student's critical thinking skill in the 7th grade of junior high school at Bustanul Ulum Panti Jember.

METHODS

This study is research and development (R&D) with ADDIE (Analysis, Desaign, Deve-

lopment, Implement and Evaluate) method. There are three steps in this research. Analysis step is conducted by investigate the student's condition who has low critical thinking skills and then make goal setting to improve student's critical thinking skills. Design step *is* determination of critical thinking indicator, determination learning material and making natural science learning instruments based on local wisdom including textbook, student worksheet, syllabus and lesson plan. The next step is Development, conducted by packaging activity about natural science learning instruments based on local wisdom. It is laso conducted by expert validation related to natural science learning instruments based on local wisdom result with 3 experts. Expert validation covers format, content/material, and language. On the end of this step, it will create the science learning instruments based on local wisdom that has valid validity and ready to be implemented.

The product that has been revised will be ready to be implemented to user. The users are students to know interaction between product and students. The product is science learning instruments based on local wisdom tested to 25 students in the 7th grade of junior high school at Bustanul Ulum Panti Jember. It was conducted with one shot case study through the result of pre test dan post test. Based on pre test, implementation, and post test will conducted normal gain test with equation 1.

$$g = \frac{Xm - Xn}{100 - Xn}$$ ....(1)

With
g = gain value
Xm = post test value
Xn = pre test value

To interpret gain value, used guide on Table 1.

Table 1. Interpretation of N gain value

N gain value	Interpretation
$g \geq 0.7$	**High**
$0,7 > g \geq 0.3$	**Moderate**
$g < 0.3$	**Low**

Bustanul Ulum Panti Jember was chosen as test location because it is located in Panti specially Kemiri Kali Kepuh Gunung Pasang Jember, where that area is the coffee estate which is very excellent produk in Jember. Most of students at that school are children from the society around who works in coffee estate. Ge-

nerally, the students at that school know about coffee, but they don't know about the history, benefit and what substance of coffee. It is not good because the students who live in coffee estate don't know about the condition around them.

Instruments of research in this study are Format of learning formulation for each subject contains and material with critical thinking skills indicator, judgement format for science education expert, test for assessing critical thinking skills, questionnaire to measure the students and teacher's difficulties in using instrument, format of observation form of student's critical thinking skills in doing experiment, and interview guideline to complete data from questionnaire and observation.

RESULTS AND DISCUSSION

The main product of this research is science learning instruments based on local wisdom. Those are Syllabus, lesson plan, student worksheet and textbook. Before implementation, the instruments are validated by expert judgment.

The first step was syllabus analysis arranged based on curriculum 2006 as basic to arrange syllabus, lesson plan, student worksheet and textbook. Syllabus and lesson plan were arranged based on PP No 19 Tahun 2005 pasal 20. Lesson plan and textbook were arranged as suplement for teacher and student to complete science learning instruments based on local wisdom. This textbook shows essential concept based on KTSP 2006, supported figures based on the condition around student's environment, example, and question.

On Design and Development step, the researcher designed the textbook and student worksheet based on students' environment. It was developed so that the students had awareness to their environment.

Local wisdom environment in each place in Indonesia should be explored and done by Indonesian people **(**Malau, 2013**).** Most of local wisdoms haven't been known by young generations. How to bequeath local wisdom to young generation? The answer is through education.

Learning instruments based on local wisdom has been produced in the form of syllabus, lesson plan, textbook, students worksheet, and assessment to improve student's critical thinking skills in the junior high school Bustanul Ulum Panti Jember. The learning instruments

contains competencies, indicators and goals of learning, essential concepts based on curriculum 2006, the activities of students in a form of experimental instruction, pictures and photos, problem examples, and exercises based on coffee estate.

On the implementation step, it was conducted by implementation in the junior high school Bustanul Ulum Panti Jember during 4 months (July till September 2015). The objective of this implementation was to make assessment from experts and teacher. Student's response related to use of the result of the science learning instrument based on the local wisdom by expert judgment shown in Table 2.

Table 2. The result of expert's validation on science learning instruments based on local wisdom.

Nu	Learning Instruments	Total Score	Average	Category
1	Content/ Material	105	4,20	Valid
2	Format	108	4,32	Valid
3	Language	109	4,36	Valid

* Learning Instruments (Syllabus, Lesson Plan, Textbook, Students Worksheet, Assessment)

Table 2 shows the result of questionnaire assessment by experts from content/material, the score is about 4.20. This score was got from the average of validation score, where the total score of validation is 105 then divided to the total of statement aspects (25), so science learning instruments based on local wisdom from content/material got 4.20. While from the format, the score is 4.32, and from the language it is 4.36. Science learning instruments based on local wisdom is valid if total score above or equal to 4,00 and less valid if it below 4,00 (BSNP, 2008). Thus it can be concluded that science learning instruments based on local wisdom has valid criteria to be used. On this step, we also get suggestion from the experts i.e. a little correction about concept so that there is no mistakes and suitable with EYD.

The result of questionnaire shows that the teacher's response is 79% lies on good category. Teacher's response of lesson plan on good category is 76%, lesson plan is 76%, and very goog response is 80% and 84% on textbook and student worksheet. Result of the teacher's response on science learning instruments based on local wisdom can be seen on Table 3.

Table 3. The result of teacher's response of science learning instruments based on local wisdom.

Nu	Instruments	Total Score	%	Category
1	Syllabus	19	76	Good
2	Lesson Plan	19	76	Good
3	Textbook	20	80	Very Good
4	Student Worksheet	21	84	Very Good
	Average		79	Good

Based on 25 students of 7th grade of Junior High School who give the questionnaire back, generally from textbook 72% students choose good and very goog category and only 28% who choose moderate, low and very low. While from student worksheet 84% students choose good and very good category, and only 16% choose moderate, low and very low category. Result of the student's response on the science learning instruments based on local wisdom as shown in Table 4.

Table 4. The result of student's response about science learning instruments based on local wisdom.

Nu	Learning Instruments	Total of Students	Percentage	Category
1	Student book	18	72	Good and very good
2	Student worksheet	21	84	Good and very good

In this research, besides validation of science learning instruments based on local wisdom, also be expected to improve student's critical thinking skills, because many people think that somebody which has critical thinking skills if we can debate in public. Even though, critical thinking has wider meaning than that. Arnyana (2008) Reported that critical thinking was skill to solve the problem. While Ibrahim (2008) stated that critical thinking is skill to do knowledge investigation or something believed based on the supported fact. Critical thinking is defined as reflective thinking and reasonable to decide what is believed or done. On Bloom's taxonomy, Cognitive domain as critical thinking definition is synthesis, analysis, and evaluation. Based on that definition, characteristics of critical thinking include active process, reflective, reasonable that direct to decide what sure thing done. Ong and Borich (2006) defines critical thinking from a pedagogic perspective

and calls it an ability to identify issues and assumptions, recognize important relationships, make correct inferences, evaluate evidence or authority and deduce conclusions.

Evaluate step was conducted by analyzing critical thinking skills i.e. determine indicator process of student's critical thinking skills in the science learning that would be improved. The determination of indicator was based on literature review related to the critical thinking skills. Table 5 shows the information on indicator of the development and activity of the student's critical thinking skills.

Table 5. Indicator and student's critical thinking activity

Indicator	Activity
Interpret	Compare various, criteria, regulation or procedure in getting data
Analyze	Identify actual proofs and connecting among concepts
Evaluate	Assess credibility of questionand descrption
Inference	Account the statement based on element need related to concludethe problems

After conducting good preparation in Design and Development step so it was ready to be implemented to 25 students of 7th grade of Junior High School of Bustanul Ulum Jember. The result and implementation of developing science learning instruments based on local wisdom is moderate category. Based on N gain value it shows that student's skill in interpretation and evaluation get 0.46. The inference has the lowest value (0.44) if it to be compared with indicator of another skills. From all indicators, the average N gain is 0.47 with moderate interpretation.

Table 6. The comparison result of pre test dan post test value each students' critical thinking indicator

Indicator	N	Xn	Xm	N gain
Interpret	25	60.5	78.8	0.46
Analyze	25	62.3	82.3	0.53
Evaluate	25	63.6	80.3	0.46
Inference	25	60.2	77.7	0.44
N gain average				0.47

The result of critical thinking skills have significant improvement using science learning instruments based on local wisdom. It is caused by the change of learning instruments that can improve the student's critical thinking skills,

especially on classify, assume, predict, hypothesize, analyze, conclude, and evaluate This result similar to the other researcher (Susanti, 2012) which developing practicum guideline of genetics could train student's critical thinking skills. Further, Hassoubah was reported that people who think critically will evaluate and then conclude something based on fact to make a decision. So one of people characteristics who think critically will always look for and explain relation between the problem discussed and the relevant experience.

The meaning of critical thinking often depends on values and culture; for example, in some cultures, being critical may be interpreted as "argumentative" or "being critical of others" (Ibrahim, 2008). Critical thinking is think reasonably and reflective through emphasize making decision about what is believed and done. Critical thinking is activities of analyzing idea to more specific, differ sharply, choose, identify, study and develop to make it more perfect.

Critical thinking skills are real proof that needed in learning activity. Johnson (2007) was stated that critical thinking is an integration process that enabled somebody to evaluate the argumentation, asumption, logical and language that underlie what people's thinking. The process of critical thinking can be known through student's skill in giving verbal reasoning, analyzing argument, thinking a hypothesis, using probability and uncertainty, making decision in solving the problems (Helpern, 2012). This statement show that critical thinking skills begin with doing analysis process of case then gives idea related to proof the case and the end is able to take a decision in problem solving. Hyytinen et al (2015) also was explained that critical thinking skills were skills to analyze, interpret, evaluate and solve the problems.

Science learning instruments based on local wisdom was concentrated on giving problem and case. It was quite effective to give impact of develope student's critical thinking skills. Popil (2011) was reported that the giving some case on the study are effective method to promote the facilitation of active learning, helping clinical problems and to encourage student's critical thinking skills. Through that case study, the students will begin to compare data invention, make invention of relation, make argument and look at the problems back till make decision.

CONCLUSION

Based on the results, it can be concluded that science learning instruments based on local wisdom has been valid and reasonable to be used in junior high school because it getting value 4.20, 4.32, and 4.36 from expert validation. Besides that, science learning instruments based on local wisdom that has been developed can improve student's critical thinking skills because N gain average value is 0.47 with moderate interpretation. Local wisdom should be conserved and implemented in education. Education activities that can be done are integration of local wisdom in lesson content/material, developing test, developing textbook, and developing instructional model.

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