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RESEARCH ARTICLE

DEVELOPMENT OF A PROBLEM BASED LEARNING MODEL BASED ON SOCIO SCIENTIFIC ISSUES TO IMPROVE STUDENT CRITICAL THINKING SKILLS ON MATERIALS FOR ENVIRONMENTAL CHANGE AND CONSERVATIONIN SENIOR HIGH SCHOOL

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Abstract

This study aims to determine the validity, practicality, and effectiveness of the *problembased learning* model based on *socioscientificissues* on critical thinking skills in students.Changes in the global era in the development of knowledge and technology in the 21st century, especially related to the world of education in Indonesia. One of the explanations regarding the development of 21st century learning is critical thinking and problem solving skills, so a teacher must have innovation in learning. One of them is by developing an innovative *problembasedlearning* model based on *socioscientificissues*. This research is a development research using a 4D development research model which consists of four research stages, namely the definition stage, the design stage, the development stage, and the deployment stage. This research was conducted at Senior High School of Muhammadiyah 3 Jember, class X MIPA, academic year 2020/2021 with a total of 28 students, based on the results of the study to see the validity of getting validation results, namely 97.14% which stated very valid, to see practicality consisted of three things, first was the implementation of learning which got 82.3% results, second was the teacher response got 95.19% results, the third is the student response to get a result of 90.9%, the three things state that it is very practical, to see the effectiveness obtained from the test of critical thinking skills, the score is 81.5, which means it is very high. The conclusion from the results of the study states that the *problem based learning* model based on *socio scientific issues* is valid, effective, and practical to be used in improving students critical thinking skills.

Introduction:-

Changes in the global era in the development of knowledge and technology in the 21st century, especially related to the world of education in Indonesia. Changes and renewal of the education curriculum occurred in 2013 which is generally known as the 2013 curriculum. The renewal of the learning process in the 2013 curriculum lies in learning that emphasizes the modern pedagogic dimension, namely using a scientific approach (*scientific approach*) (Wilsadkk, 2017). One of the explanations regarding the 21st century learning framework is the ability to think critically and solve problems. The ability to think critically will be able to make students assess whether a statement is indeed true and proven to exist or does it still need to be questioned (Julia, 2017). The demands of the 21st

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century make teachers must have ways to improve students' abilities in dealing with them. Based on the results of the needs assessment (needs assessment) for biology teachers, most said that the learning process for biology on the subject of environmental change and preservation is still dominated by teachers using the lecture method, whereas in the basic competencies in the 2013 curriculum required in these materials students must be able to analyze and solve problems (Nabila & Nana, 2019). The teacher-centered learning process results in students critical thinking skills do not develop because students only accept the material presented by the teacher in learning, so a teacher must have innovation in learning. One of them is the innovation of learning model development.

The learning model itself is a plan or a pattern that is used as a guide in planning learning in the classroom. The model is a general pattern of learning behavior to achieve the expected competencies or learning objectives (Darmadi, 2017). One of the learning model developed is the *problem based learning* model. *Problem Based Learning* is learning model who has problem based that uses real world problems as a context for students to learn about critical thinking in problem solving, as well as to acquire essential knowledge and concepts from the subject matter (Sardar, 2019). *Problem Based Learning* also presents a variety of authentic problem situations to students (Ceker&Ozdamli (2016). *Problem based learning* is learning that focuses on solving real problems, the process by which students carry out group work, feedback, and discussion (Restidkk, 2015). Based on the preliminary studies that have been carried out, *problem based learning* has a drawback, namely if students do not understand or are less interested in the material then students will find it difficult to solve problems and without student understanding as to why they are trying to solve the problem being studied, they will not learn. what they want to learn, thus requiring an approach that is able to increase interest and motivation in what they are learning. One approach that is expected to complete this is the *socio scientific issues* approach.

Socio Scientific Issues are dilemmatic or problematic issues where scientific knowledge (biology) and social awareness are interrelated with each other and present mental conflicts that require decision-making abilities to solve them. In order to make decisions, in addition to being based on scientific knowledge of science (biology), a person also involves a humanistic social perspective in the form of moral-ethical considerations (Yerdelendkk, 2018). *Socio Scientific Issues* can serve as a good learning context, enabling students to understand the importance of knowledge in everyday life and the surrounding environment so as to make the lessons learned by students more meaningful (Evagoroudkk, 2012). The importance of the *socio scientific issue* to provide meaningful learning situations for students so that they can apply their biological knowledge to the social atmosphere in the classroom so that it can affect the interest and motivation of students to find meaning in what they learn. The use of *socioscientificissues* can be used as a link to real problems in society and a basis for students to explore science content.

Problem Based Learning model and *Socio Scientific Issues* approach are in accordance with the current scientific approach. Both complement each other by looking at the needs of students in the 21st century, based on this statement by integrating the *Problem Based Learning*learning model based on Socio-Scientific Issues into learning can help students think critically, not only involving knowledge but also requiring attitudes and skills to respond and solve existing environmental problems, besides that, learning based on *Socio Scientific Issues* has the potential to support the development of intellectual abilities, communication skills, social attitudes, concern, and student participation as well as awareness of the relationship between science and social life (Gutierez, 2015), with this learning model, it is hoped that it can improve students critical thinking skills which are the demands of the 21st century. research about *socio scientific issues* in learning have been carried out. However, learning based on Socio-Scientific Issues, especially at the SMA/MA level, is still a lot that has not been developed in a lesson. Based on this statement, further studies are needed to find out how learning using the *Problem Based learning* model based on *Socio Scientific Issues* can be applied validly, effectively, and practically at the secondary school level, in senior high school.

Research Method:-

This research is a type of research and development (Research and Development). Research and Development method is a research method that produces products that can be in the form of models, modules or others. This research design uses a 4D (four-D) development model developed by SivasailamThiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (Alfianika, 2018). The research is planned for the even semester of the 2020/2021 academic year. The place to carry out this research is at SMA Muhammadiyah 3 in the Jember area, East Java. The subjects of this study were 10th grade senior high school.

Data analysis technique:-

Validity:

Validity assessment requires data on the quality of learning model products obtained from the results of the validation of learning model products. The data obtained are descriptive and quantitative. Furthermore, the data from the validation results were analyzed using the percentage data analysis technique, with the help of the following formula :

V= validity
$\sum_{x1}$ = total empirical score
$\sum_{x2}$ = maximum total score

$$v = \frac{\sum x_1}{\sum x_2} \times 100$$

(Akbar, 2015)

The percentage data that has been obtained is then converted using an assessment category that refers to the validity criteria according to table 1.1.

Table 1.1:- Category Validity Assessment.

No.	Percentage (%)	Category	Description
1.	81,25 < x ≤ 100	Very Valid	The product is ready to be used in the field for learning activities
2	62,5 < x ≤ 81,15	Valid	The product can be continued by adding something less, the additions made are not too big and not basic
3	43,75 ≤ x < 62,50	Not Valid	The product is revised again with careful attention and re-examination
4	25,00 ≤ x < 43,75	Invalid	The product must be revised as a whole and fundamentally about the product content

(Akbar, 2015)

Student Critical Thinking:-

$$ValueofCriticalThinkingSkills = \frac{\text{Score obtained}}{Maximumscore} x\ 100\%$$

The category of critical thinking skills assessment is listed in table 1.2.

Table 1.2:- Critical thinking skills assessment category.

No.	Score	Category
1.	81,25 < x ≤ 100	Very high
2.	62,5 < x ≤ 81,15	High
3.	43,75 ≤ x < 62,50	Not high enough
4.	25,00 ≤ x < 43,75	Not high

(Akbar, 2015)

Results:-

Validity:-

The results of product validation are in the form of quantitative data obtained from the expert assessment (validator) of the product. The results of product validation can be seen in Table 1.3

Table 1.3:- Validation result assessment.

Instrument/Product	Validator	esult of Validation	Category
Learning Implementation Plan (RPP)	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	95%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	96,25%	Very Valid

Learning Syllabus	Expert Lecturer 1	100%	Very Valid
	Expert Lecturer2	100%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	100%	Very Valid
The result grid student learning (pretest andposttest)	Expert Lecturer 1	93%	Very Valid
	Expert Lecturer2	95%	Very Valid
	Practitioner Tacher 1	97%	Very Valid
	Practitioner Tacher 2	95%	Very Valid
	Validation Average	95%	Very Valid
Learning Materials	Expert Lecturer 1	95%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	98,5%	Very Valid
Worksheet (LKPD)	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	99%	Very Valid
	Validation Average	97%	Very Valid
PIACCE learning model guide	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	97,25%	Very Valid
Critical thinking skills	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	97%	Very Valid
	Practitioner Tacher 1	97%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	96%	Very Valid
The average overall validation		**97,14%**	**Very Valid**

The data in Table 1.3 shows the results of product validation from experts and practitioners, obtained an average value of 97.14% which is included in the very valid category. Based on the results of the product validation, it can be concluded that the product validation sheet can be used as a reference for validating the developed product.

Results of critical thinking skills:-

Table 1.4:- The results of the achievement score of critical thinking skills.

Meeting	Number of Students	Average critical thinking skills test result	Category
Meeting 1	28	77	High
Meeting 2	28	86	Very High

The data in Table 1.4 shows the results of the achievement scores of students critical thinking skills, there are 2 meetings and the average score at meeting 1 with a score of 77 indicates a high category, while at the second meeting a score of 86 indicates a very high category. These results indicate an increase in the achievement of students critical thinking skills during learning after using a *problem based learning* model based on *socio scientific issues*.

Discussion:-

Based on the results of the research that has been done, there are validation results and results from critical thinking skills. At the validation stage, it is expected to make learning tools more precise, effective, and tested.This validation stage is carried out by validators, validators in research on developing problem based learning models based on socio scientific issues consist of 2 expert validators (lecturers) and 2 users or practitioners (teachers).The validation results from the learning syllabus get an average of 100% with a very valid category, the validation results from the test questions of student learning outcomes get an average of 95% with a very valid category, the validation results from the learning materials get an average of 98.5 % with a very valid category, the validation results from student worksheets get an average of 97% with a very valid category, the validation results from the problem based learning model guide based on socio scientific issues get an average of 97.25% with a very valid category, and the results of the validation of critical thinking skills questions get an average of 96% with a very valid category, based on the overall results of the validity test get an average of 97.14% which states the category is very valid. These results state that the problem-based learning model product based on socio-scientific issues can be continued to the learning practice stage.

The next stage is to test students critical thinking skills using a problem based learning model based on socio scientific issues. There are 2 meetings to get the results. the first meeting got 77 results, while the second meeting got 86 results, there was an increase in the results of students critical thinking skills after using a problem based learning model based on socio scientific issues.besides that there were also changes in the way students communicate both in groups and alone, namely students are more critical in giving opinions, then from social attitudes, namely students are easier to interact and express their opinions, and student participation, namely students are more independent and dare to express their opinions according to the real truth.

Conclusion:-

Based on the research results obtained, the problem based learning model based on the socio scientific issue has met the valid, practical, and effective categories, then the problem based learning model based on the socio scientific issue can be applied in learning and can be used by teachers to help improve students critical thinking skills.

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