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A NEW MODEL ORIENTED ON THE VALUES OF SCIENCE, ISLAMIC, AND PROBLEM-SOLVING IN ELEMENTARY SCHOOLS

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Abstract

Purpose of the study: This research aims to develop problem-based learning that integrates scientific values and Islamic values (PBL-ISI) model.

Methodology: This type of research using Research and Development (RnD). Research methods development refers to the learning system design model Borg and Gall. Consideration usage method because the stages of the model can be seen clearly from the learning components interacting with a specific purpose.

Main Findings: PBL-ISI model is appropriate to generate scientific and problem-solving skills for elementary school students.

Application of this study: PBL-ISI model can be implemented on scientific values and manner oriented curriculums.

Novelty/originality of this study: A learning model that is integrated with the values of science, Islam, and problem-solving in elementary schools.

Keywords*: New Learning Model; Scientific values and manner; Problem-solving; Scientific.*

1. INTRODUCTION

The current 2013 curriculum represents learning in the 21st-century life by demanding learning skills that must be mastered by students, such as creativity and innovation, critical thinking and problem solving, communication and collaboration, and literacy skills (Van Laar et al., 2017). Recent studies stated that the availability of learning materials to support students' skills in solving problems could not shape students' scientific thinking (Gresnigt et al., 2014; Howgego, 2018; Huang et al., 2018). Basically, problem-solving capabilities can be trained through several stages, namely planning, search data, writing drafts, discussion, and improvement (Hämäläinen et al., 2019; Jahnke & Liebscher, 2020; Jena & Chavan, 2017; Liu et al., 2019). Thus, the ability in terms of problem-solving and scientific thinking becomes the primary need of students, among other learning skills in the 21st century.

Problem-Based Learning (PBL) is a learning model that is directly related to students' abilities in problem-solving and scientific thinking. The PBL model is an active and structured pedagogical learning where students are placed as the center of the learning process. Learning activities used are presenting scenarios in the form of problems for study groups by researching and presenting solutions adjusted to the main problem (Hmelo-Silver, 2004). In the PBL model, some activities are

following scientific values, namely researching and presenting solutions in accordance with existing problems. PBL is based on the concept that students can learn socially. Every learning process enables students to understand new knowledge through elaboration, collaboration, and questions to build student knowledge (Wyness & Dalton, 2018).

Islamic values that instill morality and scientific behavior affect students' problem-solving abilities (Izzati et al., 2019; Nurdyansyah et al., 2017; Umami et al., 2019). Also, scientific values with authentic assessment very influential scientific thinking ability of students (Dazzi et al., 2019; Kurilovas & Kubilinskiene, 2020). With the ability to think scientifically so students can solve various problems that it faces (Kłeczek et al., 2020; Liu et al., 2019). While the scientific approach is the use of steps as well as scientific theorems in the learning process (Durmus, 2015; Valverde-Albacete et al., 2016). The applied scientific step includes specifying the problem, propose hypotheses, collect data, and draw conclusions (Baars et al., 2018).

However, the implementation of the educational learning process at the primary level encounters several problems such as 1) the difficulty of students at the primary level to think logically because there is no early habituation, 2) teaching is only textual without giving the contextual meaning so that students have difficulty in creating and think scientifically. In addition, 3) students have not been able to take a stand independently to overcome the problems faced so that students have not been able to make decisions to solve the problems they face. 4) The delivery of learning by educators has not integrated science and Islamic values into learning so that students do not yet have strong and complete knowledge related to the cultivation of morals, character, and values in learning. Finally, 5) no alignment and inculcation of Islamic values and science are programmed either in the implementation of learning plans, textbooks, or student activity sheets in the learning process, so learning is trapped in the dichotomy of science and religion (Nurdyansyah, et al., 2017).

Mathematics subject can basically be used as a place to instill the values of Islamic and the development of science in students (Shanley et al., 2019). Through the lessons of mathematics are expected to help the learners to be able to think and solve existing problems (Boud & Feletti, 2013; Christ et al., 2019; Koichu, 2019), so that students are able to put forward ideas, patterns of thought, the latest data, and real participation in the use of ability analysis of inner, imaginative students (Guo et al., 2019; Kim et al., 2019). The reality on the ground indicates that the delivery of the learning of mathematics material the countdown is running very simple operations without the existence of planning and design that are mature, so far from what was expected by the Government (Asongu et al., 2019; Besgen et al., 2015; Prince, 2004; Sullivan & Puntambekar, 2019; Techakosit & Wannapiroon, 2015; Woodill, 2011). A lack of understanding in depth the elementary students against the basic concept of scientific thinking on mathematical subjects make students lazy and less interested in the teaching and learning process (Caldas et al., 2020; Hermann & Bossle, 2020).

Model development is expected to be one of the innovative ways to improve problem-solving and scientific abilities in the subject of mathematics in elementary school so that learning can proceed with appropriate and effective called problem-based learning with patterns of integration of Islamic and scientific values (Melita et al., 2019). Thus, a problem-based learning model that can integrate the values of science and Islamic to improve the ability of scientific thinking and problem-solving at

the elementary school level is needed. In this study, the problem-based learning model that integrates scientific values and Islamic values are called the PBL-ISI model.

2. LITERATURE REVIEW

Problem Based Learning

Problem-based learning is a set of teaching models that uses problems as a focus to develop problem-solving skills, materials, and self-regulation (Hmelo-Silver, 2004). PBL model enables activities that support scientific values such as researching and presenting solutions according to existing problems. This model is based on the concept that students can learn socially. In each learning process, students understand new knowledge through elaboration, collaboration, and questions to build their knowledge (Chen, 2008; Yew & Goh, 2016). PBL requires students to work collaboratively in small groups to solve complex and challenging problems and encourage a deeper understanding of a problem or problem through the application of research, prior knowledge, and the production of 'solutions' in various methods (Wyness & Dalton, 2018).

The characteristic of PBL are: 1) learning must be student-centered. 2) Learning must occur in small student groups under the guidance of the teacher. 3) The teacher becomes a facilitator or learning guide. 4) Authentic problems are mainly encountered in the sequence of learning before preparation or learning has occurred. 5) Problems serve as learning tools to achieve the knowledge needed and problem-solving skills needed to ultimately solve a problem. 6) New student information is obtained through independent learning. In short, PBL is a pedagogical approach that allows students to learn while actively engaging with meaningful problems with students given the opportunity to solve problems in a collaborative atmosphere and create mental models for learning and form independent learning habits through practice and reflection (Abdulfattah & Supahar, 2019; Dochy et al., 2003).

Science and Islamic values

Implementation of the model of the basic concept of Islamic values-based scientific thinking and scientific development model of the basic concept of thinking scientifically-based Islamic values and science provides vast spaces to students to be able to find a scientific concept contained in the article, the journal, scientific and other literacy studies (Kaya, 2014). Students can find solutions to the problem in a comprehensive manner (Allen et al., 1994; Istikomah et al., 2018: Hairus., 2009).

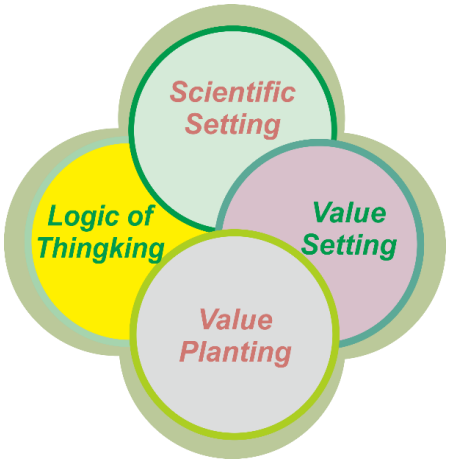

Figure 1. The Connectedness of Science and Islamic values

Figure 1 shows that there is a strong connectedness between science-based education and education-based Islamic values. Both corroborate and bound each other. Unlike the view of most people who create a dichotomy between science and religion, learning using a scientific approach needs to be embedded in the learning process. However, this kind of learning must be accompanied by the cultivation of the values of Islamic, as the purpose of education, Indonesia emphasized the advancement of the character and values of the nation (Nurdyansyah, 2018).

3. METHODOLOGY

The research and development method used to develop the PBL-ISI model follows the steps consisting of 1) collection of information, 2) design, 3) the initial product development, 4) early trials, product revision, 5) product revision 1, 6) the main trial, 7) product revision 2, 8) operational trials, 9) the final revision (Gall et al., 2003). Farley-Ripple et al. (2018) stated that the research development procedure consists of two main objectives, namely design the model learning and test the effectiveness of products in achieving goals. Also, Borg and Gall (1989) stated that educational research and development is a process used to develop and validate an educational product. The PBL-ISI in this research was reported in three activities, namely 1) development, 2) validation, and 3) effectivity test. Analysis of the effectiveness of the PBL-ISI test models used descriptive statistics and parametric statistics through t-tests with the Paired Samples Test formula. All of the tests were carried out with the help of the SPSS 18 program. The basis for the t-test decision was carried out by looking at the significance values comparing the calculated p-values and p-value tables. If the significance value of Sig. <0.05, then there was an influence between the two variables.

The research involved 500 participants who are 3rd-grade elementary students in Sidoarjo, East Java, Indonesia, has chosen using a purposive sampling technique. At the time of data collection, the participants were undergoing an odd semester of the 2019-2020 school year.

The instruments used were PBL-ISI model validation sheets, questionnaire sheets, and test sheets. The PBL-ISI model validation sheet is in the form of a questionnaire by three experts, namely material experts, language experts, and design experts, and contains aspects of content expert, design expert, and linguist assessment. Meanwhile, questionnaires are in the form of questionnaires containing components in scientific thinking attitude, mathematical process skills, linking scientific to Islamic values that are filled in by students. The test sheet consists of two, namely the scientific thinking test sheet and problem-solving. All instruments have been tested for validity and reliability so that they can be used well in ongoing research and are not subjective.

4. RESULTS

PBL-ISI Model Development

The PBL-ISI model was created with two stages of integration, namely the integration of the values of science and Islamic (ISI) and integration into the PBL model (See Figure 2). Based on a literature review on the Integration of ISI values, it is produced that science values consist of problem-solving,

critical thinking, logical thinking, creative thinking, and scientific thinking (Amir et al., 2019; Kemedikbud, 2013). Islamic values consisted of honesty, independence, responsibility, ethic, and scientific order (Nurdyansyah, 2018). Philosophically, the integration of scientific values with Islamic values was compatible because cognitive abilities in logic-oriented learning must be carried out with a good attitude.

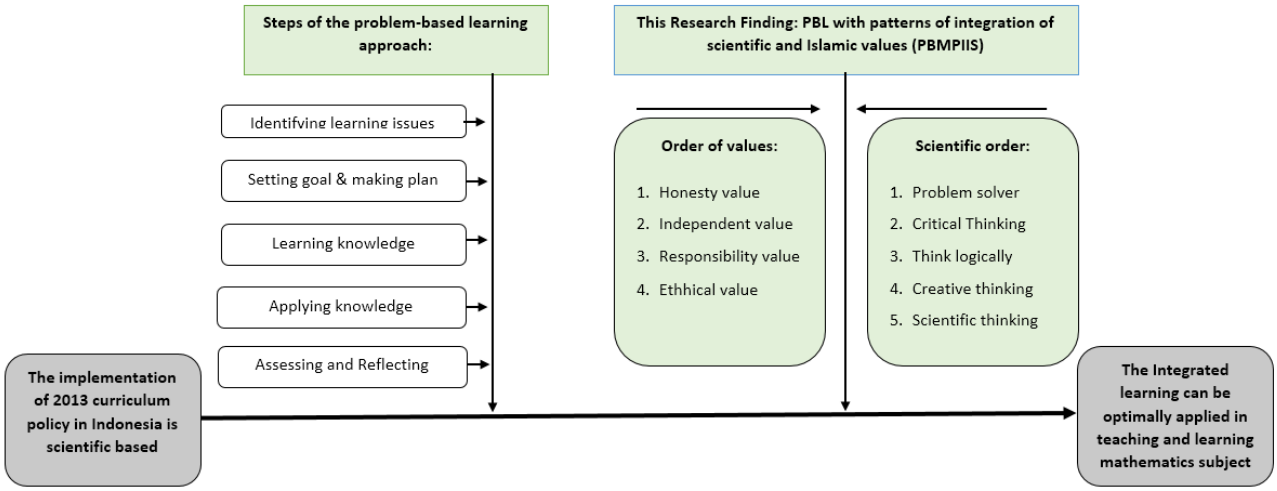

Figure 2. Flowchart of PBL-ISI Model Development

In implementing ISI values, an appropriate learning model is needed. Wyness & Dalton (2018) states that the PBL model has the main character in its implementation, namely the investigation activity through problem provision. PBL model syntax consists of identifying learning issues, setting goals & making plans, learning knowledge, applying knowledge, assessing, and reflecting (Beaumont et al., 2007; Miao et al., 2000). In this study, researchers integrated ISI values into the PBL syntax to get the PBL-ISI model syntax (See Table 1).

Table 1. PBL-ISI Model Syntax Development

Syntax model	Description
Fase 1 : Identifying problem	Educators did initial reflection and delivery of existing problems and produced several possible themes for investigation. The topic could be either global or local, but this must be a problem that exists with students and provides sufficient territory for students to investigate. Students were guided to find and express things that are known and problems that exist and are related to arithmetic operations and time units (in daily life).
Fase 2 Identifying learning Issues	Educators raised problems or ask students to read and listen to descriptions that contain problems. Educators provided students with the opportunity to identify as many agenda agendas as relevant to the subject matter, then one of them is selected and formulated in the form of a hypothesis (temporary answers to problem questions)

Fase 3 : Setting Goal and Making Plan	Students were given the opportunity to gather various relevant information, read literature, observe objects, interview with speakers, conduct their own trials, and so on. The consequence of this stage was that students learn actively to find something related to the problem at hand, thereby accidentally connecting students with the knowledge they have.
Fase 4 Learning and Applying Knowledge	Students discussed and associated the concepts that have been obtained with social life, Islamic values, and social society in the surrounding environment.
Fase 5 Assessing and Reflecting	Educators examined the concept of students if there are still misconceptions. Concept strengthening needed to be carried out at the end of learning because concepts emphasized at the end of learning will have longer retention compared to if not established or suppressed by educators at the end of learning.

PBL-ISI Model Validation

The PBL-ISI model validation was reviewed from the content expert, expert design assessment, and linguist assessment. Content experts at this stage, data obtained from consultations with expert content that one person is the expert in mathematics education in schools. The data obtained through structured interviews, the results of the consultation, and the question form. Expert design assessment performed by expert design resting on several criteria, among others: an attractive design, shape, and size of the corresponding font, color pictures, color, and the alignment of the image. Linguist assessment conducted by the expert views of the statutes, the spelling, the effectiveness of the sentence, punctuation, the vocabulary used, communicative language.

Table 2: PBL-ISI Model Validation by Experts

Aspect	n	Results (%)
Models can assist in finding the signs for resolving the problem	500	95.3
Models can provide motivation to students to continually develop themselves	500	93.1
The model encourages students to be actively, scientifically, and morally	500	91.4
Models interesting, easy to understand and innovative	500	90.1
	Total	92.4

The results of the validation by experts showed that the results generally have an average that was not much different in four aspects (see Table 2), namely models could assist in finding the signs for resolving the problem with a mean of 95.3%, models could provide motivation to students to continually develop themselves with a mean of 93.1%, the model encourages students to be actively, scientifically, and morally in learning with a mean of 91.4% and models interesting, easy to understand and innovate with a mean of 90.1% so that the total mean in the results of the product expert test was 92.4%.

All data from the results of the review, assessment, and discussion with expert content, design experts, and linguists relied upon in revising the model components and the contents of the material before it was tested on students. Based on these results, the model was considered feasible, and a small group test and a large group test could be performed to see the effectiveness of the model.

PBL-ISI Model Effectivity Test

The effectiveness test results were obtained after the implementation of the PBL-ISI Model by assessing the components of the values of science, Islamic, and mathematics subjects. In addition, students' scientific thinking and problem-solving skills were also assessed.

Table 3: Pretest dan Post-Test Component Score After PBL-ISI Model Implementation

Components	Pretest		Posttest	
	Score	Category	Score	Category
Scientific Thinking Attitude				
Respect for data	42	Low	80	High
Identify problems	52	Low	82	High
Systematic thinking	48	Low	88	High
Curiosity	56	Low	86	High
Active participation	48	Low	82	High
Mathematical Process Skills				
Numeracy skills	64	Middle	86	High
Practical skills	70	Middle	90	High
Skill in understanding material	68	Middle	88	High
Innovation skills	66	Middle	90	High
Linking Scientific to Islamic Value				
Ability to explain links	48	Low	84	High
Ability to make a frame of mind	50	Low	88	High
Reflective thinking ability	42	Low	86	High
Ability to draw conclusions	50	Low	84	High

Table 3 shows that the scientific thinking attitude of students prior to the implementation of the model is still low, but after implementation experience, significant improvement with a high category. On the other hand, the mathematical process skills and linking sains to Islamic value before the implementation of the model with a low category, and after the execution of the model increases into the high category.

To deepen the implementation of the PBL-ISI model in mathematics, the ability of scientific thinking and problem solving was also assessed using descriptive and parametric statistics, as shown in Table 4.

Table 4: Pretest dan Post-Test Skill Score After PBL-ISI Model Implementation

Skills	Test	N	Mean	Std. Deviation	Std. Er. Mean
Scientific Thinking	Pretest	500	28.52	15.21	0.698
	Post test	500	40.10	10.94	0.774
Problem Solving	Pretest	500	28.92	16.72	0.698
	Posttest	500	40.50	11.26	0.774
T		0.943		df	11.02
Sig (2-tailed)		0.00		Mean Difference	23.16
95% confidence interval of the difference	Lower	50.44			
	Upper	90.25			

Test the feasibility of different T-test pretest and posttest results implementation PBL-ISI model. Pretest details are scientific thinking ability with an average value of 28.52 and posttest value of scientific thinking ability with an average value of 40.10. The average pretest value of problem-solving ability is 28.92, and the average posttest score is 40.50. The lowest value is 50.44, and the highest value is 90.25. A big correlation with the t-value is 0.943 (positive correlation), which shows that there is a high correlation between scientific thinking and problem-solving. The value sig (2-tailed) of p-t test statistic value of 0.00 that means (<0.05), then it can be inferred that Ho is rejected and the Ha is received. The conclusion means the implementation of the PBL-ISI model is effective for enhancing students' scientific thinking skills and problem-solving.

5. DISCUSSION

The effectiveness of PBL-ISI model implementation can provide new innovation and respond to existing problems in schools, especially in the lack of understanding of students against the basic concept of scientific thinking on the subjects of mathematics and then find solving the issues facing students by implementing moral values in Islam. Therefore, in this 21st century, which is increasingly complex with various educational problems and challenges, the paradigm of the learning model requires innovations that encourage educators to maximize their role. The learning model needs to be changed from accepting students to creating and searching, from obedience to commitment, from individuals to groups, from routine to innovative and creative, from reactive to proactive, and from passive to progress through a problem delivery (Wongsila & Yuenyong, 2019). In addition, Islamic moral values can build and direct students in getting better scientific skills and thinking ability.

The learning model used by educators largely determines the quality of the process and learning outcomes in forming core competencies and basic competencies. Therefore, learning with the PBL-IS model is completely relevant to the 2013 Curriculum and other science-oriented curricula, which places students as the main element in learning. Educators also become more flexible in packaging various learning materials to be able to arouse students' learning motivation. Educators can link the material with the whole life of students so that they can grow their awareness of the benefits of learning. PBL-ISI model that is implemented in mathematics help students develop basic concepts through a series of scientific activities by observing, collecting data, analyzing, concluding to communicate the results of their investigations. This process can create innovative and creative learning (García et al., 2019: Wawan., 2018).

6. CONCLUSION

The results of the development of the PBL-ISI model through the integration of scientific and Islamic values, effectively build the skills of elementary school students in scientific thinking and problem-solving.

LIMITATION AND SCOPE FOR FUTURE STUDIES

This research is only limited to student participants in one of the provinces in Indonesia so that the results of this study can be followed up for further studies by involving a larger and wider number of participants. In addition, participants other than elementary school students are seen as having success in scientific skills and problem-solving that is better judged by their age. Therefore, the next study can be continued for the application of the PBL-ISI model at the high school and even tertiary levels.

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