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Evaluation of Teachers Understanding of the Scientific Approach and Its Influence on Learning in Elementary Schools District Leuwiliang-Bogor

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Abstrak: The implementation of the Kurikulum Merdeka in Leuwiliang, Bogor Regency, is still in a transitional period, meaning that the Kurikulum 2013 is still used as a reference for learning. The scientific approach is the standard process required in the Kurikulum 2013. It has been eight years since the Kurikulum 2013 has been running. Is it in line with the teacher's understanding of the scientific approach, which is the core of the Kurikulum 2013 in every learning process? This study aims to determine the extent to which the teacher's understanding of the concept of the scientific approach influences the teacher's application of the steps of the scientific approach in the learning process. The subjects of this study were elementary school teachers in the Leuwiliang sub-district. The results showed that of the 24 teachers, 29% had low or very low understanding, 38% were in the category of sufficiently understanding the scientific approach, and 33% were in the high or very high categories of understanding. scientific approach. The teacher's understanding of the concept of the scientific approach has a significant effect on the application of the steps of the scientific approach in the learning process.

Keywords: scientific approach, scientific approach syntax, science learning.

INTRODUCTION

The bad results of the PISA assessment, which is recognized as a reference for the quality of world education, can be considered a reflection of government policies in education. Indonesia's score has never been better than the 8th lowest in the world since Indonesia became a participant in the Program for International Student Assessment (PISA) in 2000. Finally, in 2018, it was ranked 74th out of 79 countries participating in the assessment program (OECD, 2019).

According to the results of the PISA assessment on science competence, Indonesian students are still at the level of recognizing simple scientific phenomena and interpreting data, which only requires low-level cognitive abilities. In his literature review, Fuadi (2020) identifies five causes of low scientific literacy. 1) science learning is still limited to material and text in textbooks compared to direct learning; 2) mastery of science concepts is low and tends to have misconceptions because of demands for the completion of teaching materials according to curriculum targets; and 3) students are not able to link the basic knowledge of science that they learn with the phenomena of everyday life because there is no learning experience that relates it. So that students are not able to think logically, rationally, and systematically; 4) the low ability to interpret reading due to the low reading tradition of the Indonesian people; 5) the school learning environment and climate. Learning that is still teacher-oriented does not foster

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students' inquiry abilities. Teachers are not able to manage discovery-based learning and problem-based learning, so students do not feel involved in discovering science concepts.

It is recognized that the teacher is the key to the quality of education. A teacher is someone who has strong motivation as well as knowledge and learning skills with which he can carry out a meaningful learning process through methods and approaches that are appropriate to the conditions and characteristics of students. This is an effort to shape students to become educated human beings who believe in and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become citizens who are democratic and responsible (UU No. 20 of 2003 concerning the National Education System).

The 2003 National Education System Law also mandates that intellectual resources must have competitive and comparative advantages in the global era and be ready to face the era of rapid development of cyber-physical system technology. The future skills needed are critical thinking and problem solving, creativity and innovation, collaboration, and communication skills.

According to the Kurikulum 2013 Learning Guide, the implementation of learning in the Kurikulum 2013 is designed to provide quality, interactive, and contextual learning experiences (Kemendikbudristek, 2022). Fulfilling these expectations, the learning process should take place in an interactive, inspiring, challenging, and motivating way that encourages students to participate actively. Active participation by students will build their attitudes as independent learners and give them the urge to explore knowledge. The research results of Meilani, D. and Aiman, U. (2020: 19–24) show that learning with a 4C-based scientific approach has provided opportunities for active students to gain learning experience and skills needed according to the demands of the 21st century.

Learning with a scientific approach based on scientific processes. Learning is directed at a series of learning experiences that can encourage students to be active and constructive. Knowledge cannot be simply transferred from teacher to student in order to achieve learning objectives. Learners are subjects who have the ability to actively seek, process, construct, and use knowledge. Knowledge must be a form of concept in the mind of a learner. The results of Aulia Rahmawati's research show that the application of the scientific approach influences the understanding of science concepts (Aulia Rahmawati, 2017).

The absence of student involvement in the learning process causes students to pay less attention, lose enthusiasm, and have no motivation to follow the learning process. The teacher is fixated on the textbook. The learning process, which only consists of delivering material with lectures, then having students write, and ending with giving questions, The things mentioned above have really taken away curiosity and interest in learning from students. Students just follow the flow; there is no response back from them. Low learning experiences result in students not constructing knowledge independently. As a result, students only know the concept but do not understand it. Teachers only report science facts, not teach science.

According to Jean Piaget, the development of the cognitive structure of elementary school-age children is at the stage of learning from concrete things, so learning activities must be designed through various concrete activities that maximize the function of the five senses. Knowledge will have meaning if children experience the knowledge construction process themselves. Students observe objects directly and are then able to interpret these objects.

Based on the description above, ideally the teacher already understands the steps for applying the scientific approach to learning science. However, the fact is that the lesson plans that have been made do not describe scientifically approach-oriented learning activities or their implementation. The application is limited to group work, filling out worksheets, and reading material from sources other than textbooks. The knowledge that the teacher already has about

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the scientific approach is not followed by efforts to apply it (Deti Rostika and Prihantini, 2019: 86–94).

Meanwhile, Melania L. (2019), in her research, concluded that a lack of understanding of the steps of activities in a scientific approach adds to teachers difficulties in designing lesson plans. Only 4% of teachers use the 5M activities (observing, asking, gathering information, associating, and communicating) completely and coherently (Hasnunidah, N. 2018). On this basis, it is necessary to evaluate the extent to which teachers understand the scientific approach and how to implement the scientific approach in the science learning process in elementary schools. This research was conducted as an evaluation of the Kurikulum 2013 ahead of the implementation of the Kurikulum Merdeka in Bogor Regency.

The scientific approach is very relevant to the learning process in the Kurikulum Merdeka. The two main elements of Capaian Pembelajaran (CP) are science understanding and process skills. The teacher will be able to facilitate process skills in science learning if she understands the scientific framework. The teacher's understanding of the scientific approach will greatly assist the inductive approach in teaching natural sciences and inquiry-based learning, which has an important role in learning science. The use of scientific learning has a significant effect on improving students science process skills (Irawan, 2017).

The scientific approach is defined as learning that is designed so that students actively construct concepts, laws, or principles through the stages of observing (to identify or find problems), formulating problems, submitting or formulating hypotheses, collecting data, drawing conclusions, and communicating concepts, laws, or principles found (Kemendikbud, 2013).

The scientific approach is centered on students because it prioritizes students who are active in the learning process while the teacher acts as a facilitator. From the point of view of the process, the scientific approach is a learning approach that is oriented towards scientific work steps. Thus, the scientific approach involves potential cognitive processes and can develop student character.

METHODS

This quantitative research discusses data in descriptive and inferential statistics. The instruments used are test instruments and questionnaires for teachers. The two instruments were used after going through their validity and reliability tests. The test instrument is a multiple-choice question that contains questions to explore the teacher's understanding of the concept of a scientific approach and examples of its implementation in theory. Meanwhile, the questionnaire instrument is used to see how the teacher implements the steps of the scientific approach in the learning process.

The data were obtained from class teachers or subject teachers who teach science at elementary schools in Leuwiliang District, totaling 24 people. The collected data was analyzed to evaluate the teacher's understanding of the scientific approach and its influence on the learning process.

Table 1. Research Subjects

Number	School Name	Total number of teachers
1	SDIT Khoiru Ummah	6
2	MI PUI Lamping	4
3	MI Miftahunnur	3
4	MI Albadariyah	3

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5	SDIT Ishlahul Ummah	2
6	SDIT Al Ishlah	1
7	MI Miftahul Ulum	1
8	SDN Sirnagalih 06	1
9	MI Mathlaul Anwar	1
10	SDIT Asy Syuhada	1
11	SDN Gunung Bunder 1	1
	Amount	24

Table 2. Aspects of the Scientific Approach to Test Questions

Number	Aspect	Item number
1	Scientific approach concept	1, 2, 20, 21, 22
2	Observing process	3, 4, 9, 17, 19
3	Asking process	5, 11, 18
4	The process of gathering information/trying	6, 10, 12, 14, 15, 16, 23
5	The process of associating / Processing information	7, 8
6	The process of communicating	13, 25
	Number of items	**25**

The measurement of the teacher's understanding of the concept of a scientific approach is calculated using the formula:

$$\text{Score} = \frac{Total\ score\ obtained}{Maximum\ score} \text{ X } 100\%$$

The scores obtained are then interpreted based on the mean and standard deviation into five categories.

Table 3. Assessment Category

Number	Range	Category
1	X < mean – 1,5SD	Very low
2	Mean – 1,5SD ≤ X < mean – 0,5SD	Low
3	Mean – 0,5SD ≤ X < mean + 0,5SD	Enough
4	Mean + 0,5SD ≤ X < mean + 1,5SD	High
5	Mean + 1,5SD ≤ X	Very high

To see the effect of the teacher's understanding of the scientific approach to the learning process, correlation tests and simple linear regression were used by first testing the data analysis requirements, namely the normality and linearity tests.

RESULT AND DISCUSSION

1. Descriptive Data Analysis

The questions tested are 25 questions with multiple-choice answers. After the data was processed using Microsoft Excel, the highest score was 92, and the lowest score was 20. The average score was 59.5, with a standard deviation of 20.27. With these data, the frequency distribution table can be made as follows:

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Table 4. Frequency Distribution of Test Score Values

Number	Range score	Frequency	Percentage
1	20 – 32	3	12,5%
2	33 – 45	3	12,5%
3	46 – 58	3	12,5%
4	59 – 71	7	29,2%
5	72 – 84	6	25,0%
6	85 – 97	2	8,3%
	Amount	24	100%

Based on the mean value and standard deviation, it can be determined that the score category of the teacher's understanding of the scientific approach can be obtained. Categorization is shown in the following table:

Table 5. Understanding Level Categories

Number	Range	Range scores	Category
1	X < mean – 1,5SD	X < 29,10	Very low
2	Mean – 1,5SD ≤ X < mean – 0,5SD	29,10 ≤ X < 49,37	Low
3	Mean – 0,5SD ≤ X < mean + 0,5SD	49,37 ≤ X < 69,64	Enough
4	Mean + 0,5SD ≤ X < mean + 1,5SD	69,64 ≤ X < 89,91	High
5	Mean + 1,5SD ≤ X	89,91 ≤ X	Very high

Based on the category range of scores in the table above, the scores on the test results of the teacher's understanding of the scientific approach can be categorized as follows:

Table 6. Teacher's Level of Understanding of the Scientific Approach

Number	Category	Total number of teachers
1	Very low	3
2	Low	4
3	Enough	9
4	High	7
5	Very high	1

Understanding the scientific approach includes aspects of: 1) understanding the concept of the scientific approach; and 2) implementation of scientific approach steps in the learning process. Based on the test results, the average score for understanding the aspects and dimensions of the scientific approach is shown in the following table:

Table 7. Understanding Score Based on Aspects of the Scientific Approach

Number	Aspect	Average of score	Kategori
1	Scientific approach concept	62,73	Enough
2	Observing process	68,94	Enough
3	Asking process	74,24	High
4	The process of gathering information/trying	63,64	Enough
5	The process of associating / Processing information	34,85	Low
6	The process of communicating	93,18	Very high

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Teachers must understand the scientific approach as a standard process required in the Kurikulum 2013. The concept of a scientific approach that teachers must understand is that students are able to master various materials through a scientific approach process, meaning that there is a learning syntax that encourages students' thinking skills to increase. The learning syntax in the scientific approach includes observing, asking, gathering information, associating or processing information, and communicating learning (Hosnan, 2014: 37).

Observing syntax is a form of exploration of students' curiosity. Observing can be done in the form of reading, listening, paying attention, seeing (without or with tools), or directly observing facts or events. In this case, the teacher can present videos, pictures, miniatures, shows, or original objects. Observation of real objects challenges the curiosity of students. The teacher must provide observation guidelines, clearly determine the data that needs to be taken based on the object of observation, and explain how the observation is carried out.

The teacher's understanding of the syntax of asking is in the high category. In this case, the teacher has understood that asking activities can be carried out in the form of digging up information or confirming what is already known. Asking questions in the learning process is essentially to get additional information about what is being observed or to get answers out of curiosity. In this activity, students are trained to formulate questions from what is observed, read, or heard. The ability to formulate questions forms the critical thinking necessary for intelligent living and lifelong learning.

The syntax for collecting information can be done through reading various source books, conducting experiments, writing the results of observations of objects, events, or activities, interviewing resource persons, and so on. Conducting experiments is able to develop the knowledge, attitudes, and skills of students. Through experimentation, students will record data or phenomena, analyze them, draw conclusions based on the results of their observations, and then present the observed data either in descriptive form, tables, or graphs. Through this syntax, students are expected to be thorough, honest, polite, respect the opinions of others, and be able to apply analytical skills.

The research data shows that the syntax for reasoning or processing information is a low category that is understood by the teacher. Reasoning illustrates that students are active actors in the learning process. Reasoning is the ability to classify and associate various ideas or pieces of information with previous experience or knowledge. Learners are processed to broaden and deepen their knowledge. Learning activities that can be carried out include processing observational information in the form of tables or graphs, drawing conclusions, finding solutions, and associating material with everyday life.

The syntax of communicating this is very well understood by the teacher. The teacher provides opportunities for students to communicate what they have learned in various forms. The learning activities carried out can be in the form of conveying the results of observations or conclusions based on the results of analysis either orally, in writing, or in other media (posters, mind mapping, pictures).

2. Inferential Data Analysis

Before testing the hypothesis, the prerequisites for data analysis were first tested, namely the normality and linearity tests of the data. Following are the results of the data analysis prerequisite testing:

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Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pemahaman	.135	24	.200*	.957	24	.374
Implementasi	.082	24	.200*	.977	24	.831

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Implementasi * Pemahaman	Between Groups	(Combined)	2595.292	14	185.378	3.515	.032
		Linearity	1808.898	1	1808.898	34.298	.000
		Deviation from Linearity	786.393	13	60.492	1.147	.429
	Within Groups		474.667	9	52.741		
	Total		3069.958	23			

Based on the results of the data analysis prerequisite test, the two tables show that both the teacher's understanding of the variable data and the scientific approach implementation variable in the learning process meet the requirements for parametric hypothesis testing, namely that the data is normally and linearly distributed. The Kolmogorov-Smirnov test results show that the value of Sig. 0.200 > ∝ (0.05) means that both variables are normally distributed. Meanwhile, in the ANOVA table, with a value of Sig. from Deviation from Linearity = 0.429 > ∝ (0.05), the relationship between the two variables is linear.

For decision-making, hypothesis testing is carried out on both variables. The results of hypothesis testing with correlation and simple linear regression are listed in the following table:

Correlations

		Pemahaman	Implementasi
Pemahaman	Pearson Correlation	1	.768**
	Sig. (2-tailed)		.000
	N	24	24
Implementasi	Pearson Correlation	.768**	1
	Sig. (2-tailed)	.000	
	N	24	24

**. Correlation is significant at the 0.01 level (2-tailed).

From the value of Sig. (2-tailed) of 0.000 < 0.05, there is a significant relationship between the teacher's understanding and the implementation of the scientific approach in the learning process carried out by the teacher. The Pearson correlation value of 0.768 means that there is a strong relationship (Sugiyono, 2022) between the teacher's understanding and the implementation of a scientific approach to learning.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.768[a]	.589	.571	7.571

a. Predictors: (Constant), Pemahaman

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R squared, or the coefficient of determination, shows the effect of the teacher's understanding contribution of 58.9% on the implementation of a scientific approach in the learning process.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1808.898	1	1808.898	31.557	.000[b]
	Residual	1261.060	22	57.321		
	Total	3069.958	23			

a. Dependent Variable: Implementasi
b. Predictors: (Constant), Pemahaman

The sig. Value in the ANOVA table above is 0.000 < ∝ (0.05), which shows that there is a linear relationship between the teacher's understanding of the scientific approach and its implementation in the learning process.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	81.510	4.885		16.686	.000
	Pemahaman	.438	.078	.768	5.618	.000

a. Dependent Variable: Implementasi

From the coefficients table, it is known that t count = 5.618 and Sig. = 0.000 < ∝ (0.05), thus there is a significant influence of the teacher's understanding of the implementation of the scientific approach in the learning process. From the table, the regression equation Y = 81.510 + 0.438X is obtained.

The teacher's understanding of the concept of the scientific approach influences the teacher's knowledge of the steps of implementing the scientific approach in the learning process. Especially the diversity or variety of activities in each scientific approach syntax that can be facilitated by teachers for students. The teacher is still fixated on activities that are usually carried out in the learning process. As a facilitator, the teacher must have various ideas, prepare a variety of systematic learning activities, and reason inductively through measurable empirical experience in each scientific approach.

The activity that should not be forgotten by the teacher is reflection. Learning activities end with validating the findings and knowledge acquired by students. Reflection through self-assessment can be a source of evaluation for teachers. Students can provide an assessment in the form of a scale related to the learning process they have experienced. Students can assess whether they like the activities carried out and whether they also do well in the learning process that has taken place.

It becomes necessary to program application trainings for teachers, especially in Leuwiliang District. Given that 29% of teachers are still in the low category and have very low understanding, The 'enough' category (38%) cannot be said to be professionally competent for a teacher. Competency enhancement can be carried out in the form of intensive training, workshops, and technical guidance so that teachers are able to fully understand the scientific approach, which will lead to precise implementation in the learning process. Teachers who are professionally competent are teachers who have extensive and deep knowledge about 1) the

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subject matter (field of study) that will be taught to students and 2) the mastery of methodology. Teachers have knowledge of theoretical concepts, are able to choose the right method, and are able to use it in the learning process (Athok Fu'adi, 2010: 5).

CONCLUSIONS

The results showed that of the 24 teachers as research subjects, 29% had very low and low understanding, 38% were in the enough category, and 33% were in the high and very high categories in understanding the concept of the scientific approach and its implementation steps in the learning process. While the syntax of reasoning or processing information is a syntax with a low category that is understood by the teacher both as a concept and how it is applied in the learning process.

The teacher's understanding of the concept of the scientific approach influences the teacher's knowledge of the steps of implementing the scientific approach in the learning process. Especially the diversity or variety of activities in each scientific approach syntax that can be facilitated by teachers for students.

It becomes necessary to program applicative training for teachers in the form of intensive training, workshops, and technical guidance so that teachers are able to fully understand the scientific approach, which will lead to precise implementation in the learning process.

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