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The Improvement of Science Teachers' Competence in Developing the Integrated Sciences Worksheets Based on Scientific Literacy to Support the Implementation of the Merdeka Curriculum

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Abstract: In preparation for the implementation of the Merdeka Curriculum, science learning in schools still has problems, namely; 75% of science teachers have not been able to design real problems in everyday life as scientific contexts, and only 50% of science teachers can integrate science material in an integrated manner on worksheets, and there are still very few science teachers who are ready to implement the curriculum. The purpose of this study was to determine the effect of providing technical guidance (Bimtek) on developing scientific literacy-based worksheets on the competence of science teachers. The Bimtek activity consists of six stages: pretest, material debriefing, technical guidance (Bimtek), independent activities, evaluation monitoring, and posttest. From the Bimtek activities carried out for science teachers at MGMP Pesisir Selatan districts significantly increased teacher competence in developing scientific literacy-oriented worksheets. Based on the results of data analysis and discussion, it was found that the post-test average score was higher than the pretest average score. The science teacher pretest average score was 39.95, while the science teacher posttest average score was 62.10. The percentage increase in teacher competence is 23%.

Keywords: Worksheet; Integrated science; Scientific literacy; Merdeka curriculum

Introduction

Natural Science is essentially seen as a scientific process, product, and procedure. As a scientific process, Natural Science is defined as a scientific activity to perfect knowledge about nature and to discover new knowledge. As a scientific product, science is also defined as the result of a process, in the form of factual, conceptual, procedural and metacognitive knowledge. As a scientific procedure, Natural Science is seen as a methodology or method used to find out an object through an investigation which is commonly called the scientific method (Wisudawati et al., 2014). So, science learning in junior high schools must pay attention to the characteristics of science as a process and procedure and science as a product.

Science learning in junior high schools is carried out in an integrated manner by integrating various fields of study, namely Physics, Chemistry and Biology. The objectives of learning science which are carried out in an integrated manner in junior high schools are not much different from the main objectives of integrated learning, namely increasing the efficiency and effectiveness of learning, increasing interest and motivation, and achieving several competencies at once (Trianto, 2012). Integrated science learning is often combined with several integration models at once. According to a literacy study, the integration models that are often combined include integrated, connected, webbed, and shared (Sanimah, 2019; Firdausy et al., 2018).

In the framework of science development in integrated science learning, there is a very balanced role

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of science, technology and the environment. That is, integrated science learning is used as a tool to increase students' knowledge in understanding and making decisions regarding the environment, health, economy, and other problems faced by modern society that is very dependent on technology. In order for the science learning goals to be in accordance with the competencies needed in the 21st century, scientific literacy is the current learning goal.

OECD (2017) defines scientific literacy as the ability to use knowledge about issues related to science, and with the concept of science, as a reflection of a citizen. Students who have scientific literacy are required to have the following competencies. a) Explain a phenomenon scientifically, b) Evaluating and designing science understanding through inquiry, c) Interpret data and present scientific evidence.

Nowaday, all of Junior High Schools in Pesisir Selatan districts are starting to implement the Curriculum merdeka. The structure of this curriculum consists of 144 intracurricular activities and projects to strengthen the profile of Pancasila students. The Pancasila profile strengthening project is allocated around 25% of the total JP per year for science subjects (Menpendikbudristek, 2022). This project to strengthen the profile of Pancasila students is carried out by training students to explore real issues in the surrounding environment and collaborate to solve these issues (Marliana et al., 2022).

Concerning the preparation for implementing this new curriculum, science learning in schools still has several obstacles based on the results of interviews with science teachers in Pesisir Selatan districts. First, 75% of science teachers generally need help designing real problems in everyday life as a scientific context in learning. Second, already 50% of science teachers can design science worksheets, but there needs to be integration in the presentation of material in the worksheets. This is because teachers' educational background is not from natural science but partly from physics, biology or chemistry. Third, there are still very few science teachers ready to implement the Merdeka curriculum, namely, 8% of science teachers in propulsion school.

The three problems above show that the professional and pedagogical competence of science teachers is not optimal according to the Merdeka curriculum development framework. The limited competence of science teachers will have a significant impact on students' ability to multi-represent scientific literacy at the junior high school level. The 2019 Science National Examination result show that students still have difficulty when dealing with questions that are equipped with tables, pictures, diagrams, and graphs. Students still need to become skilled at interpreting visualizations, getting enough information, then processing it to determine certain variables or solve problems in everyday life. Students are more likely to solve problems with numerical/mathematical analysis (directly performing formulas and calculations) than with physical conceptual analysis (Puspendik, 2019; Ekici et al., 2014). This shows a gap in treating science or science education even though the concept and mindset of science education are already written and use a scientific and inquiry approach (Fananta et al., 2017).

Scientific contexts are issues of science or the application of science itself in personal, local, and global situations that exist in people's lives. The scientific context according to PISA 2015 is related to health issues, natural resources, environmental quality, and natural disasters in personal, local, national and global contexts (Commission, 2000; OECD, 2017). In addition, the scope of the scientific context is not only limited to science subjects but also intersects with other literacy.

Scientific literacy has several principles, including 1) contextual, by local wisdom and the times, 2) fulfillment of social, cultural, and state needs, 3) by quality standards of learning that are in line with 21st-century learning, 4) holistic and integrated with a variety of other literacy; and 5) collaborative and participatory (Kemendikbud, 2013). In order for scientific literacy in science learning to be carried out according to its principles, representative worksheets are needed as a guide for the implementation of scientific literacy.

From the description of the importance of scientific literacy above, a teacher must be able to prepare teaching materials in the form of worksheets to guide students' scientific literacy activities (Dewi et al., 2021). This Bimtek activity for develop scientific literacy worksheets is expected to help science teachers improve their pedagogic and professional competence in implementing of curriculum (Rubini et al., 2017).

Method

This type of research is aquasi-experimental research with a quantitative approach. The research design used was a pretest-posttest group only design (Sundari et al., 2021). In this research design, one sample group is given treatment, then the effect of the treatment on the sample group is seen. Before being given treatment, the sample group was given a pretest to determine the initial ability of the sample group (Sugiyono, 2014; Hastjarjo, 2019). After being given treatment, a posttest was given to determine the final ability of the sample group. The treatment is in the form of assistance in develop Integrated Science worksheets based on scientific literacy. The effect of the treatment can be determined by comparing the results of this pretest and posttest.

The population of this study was all junior high school science teachers who were members of the Subject Teacher Conference (MGMP) in Pesisir Selatan districts. At the same time, the sample is a junior high school science teacher who participates in the Bimtek of develop scientific literacy-based worksheets full-time. Thus, 20 junior high school science teachers in Pesisir Selatan districts were involved in this study.

The Bimtek activity for develop Integrated Science worksheets based on scientific literacy is carried out in a structured and scheduled manner with several stages/steps taken to solve partner problems. The research procedure consists of six stages: pretest, material debriefing, technical guidance, independent activities, evaluation monitoring, and posttest. Details of this research procedure can be seen in Figure 1.

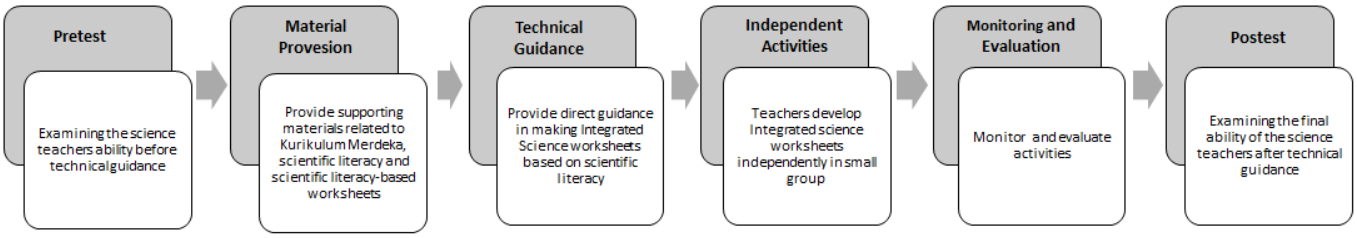
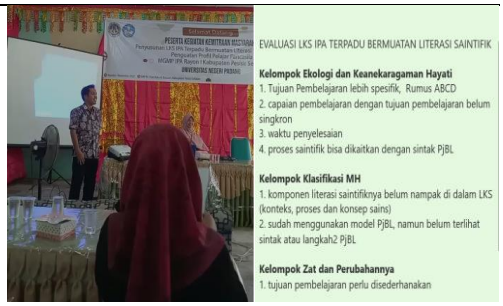


Figure 1. Research procedure bimtek activity

Based on Figure 1, the initial stage is a pretest. A pretest was conducted to determine science teachers' competence with the material before Bimtek was carried out. Then, the material was delivered by several resource persons to equip science teachers in develop scientific literacy-based worksheets. After giving the participants some understanding of the material, they are guided to make worksheets containing scientific literacy dimensions. Participants learn to make their worksheets through independent activities, and finally, these products are assessed by a team of experts (validators), and their level of achievement is evaluated. At the end of the activity, participants did a posttest to determine the competence of the science teacher after the Bimtek was completed. The activities carried out by participants during the Bimtek activities can be seen in Table 1.

Table 1. Activities of Science Teachers During Bimtek

Stages	Description	Activity Documentation
Debriefing	Participants received refresher material from resource persons who are experts in their respective fields regarding; 1) Merdeka Curriculum, 2) Scientific Literacy, and 3) Integrated Science worksheets Based on Scientific Literacy.	
Technical guidance	Participants are guided in develop Integrated Science worksheets based on scientific literacy based on technical material for preparing worksheets and asking questions directly with resource persons.	

Stages	Description	Activity Documentation
Independent activities	Participants in small groups conduct discussions and collaborate in develop Integrated Science worksheets based on scientific literacy.	  
Mentoring and Evaluation	The team assessed the Integrated Science worksheets product produced by the participants and provided feedback/input to teachers regarding the integration of the scientific literacy dimension in the integrated science worksheets.	

Tests were carried out before and after optimization activities to see an increase in science teachers' ability to make Integrated Science LKS based on scientific literacy. The instrument used to obtain data on improving teachers' abilities is used. A research instrument is a tool that can be used to collect research data and information (Sundayana, 2016). The instrument used in this study was a test. This test consists of a pretest and posttest in the form of multiple choice, with a total of 25 questions equivalent to the pretest and posttest.

Furthermore, the data obtained from this study were analyzed by descriptive statistical analysis to describe the pretest and posttest data. In this study, the normality test was used to determine the normality of the data, the homogeneity test was used to determine the similarity of the variance of the pretest-posttest data. The Mann-Whitney test was used to determine the effect of Bimtek on develop Integrated Science worksheets based on scientific literacy on the competence of junior high school science teachers in Pesisir Selatan districts.

Result and Discussion

The results obtained are related to the research objective, namely to improve the competence of science teachers in Pesisir Selatan districts in develop scientific literacy-oriented worksheets. This increase in competence is determined based on the increase in teacher mastery of knowledge related to scientific literacy and the LKS component. The teacher's knowledge before the Bimtek activity was taken from the pretest score, and the teacher's knowledge after the activity was taken from the posttest score. The recapitulation of the pretest and posttest scores for mastery of teacher knowledge is shown in Table 2.

Based on Table 2, it is explained that the minimum pretest value is 24, and the maximum value is 52, with a standard deviation of 8.61. The minimum score for the posttest is 45, and the maximum score is 84, with a standard deviation of 13.23. When viewed from the acquisition of the average score of the two tests, the average value of the pretest is 39.95, and the average value of the posttest is 62.10 from the ideal score of 100. From the results of this descriptive statistic, it is known that the average posttest score is higher than the

average value of the pretest, with a percentage increase of 23%.

Table 2. Results of Statistical Analysis of Pretest and Posttest Scores for Science Teachers

Descriptive Statistics	Value	
	Pretest	Posttest
Number of participants	20.00	20.00
Minimum	24.00	45.00
Maximum	52.00	84.00
Median	40.00	62.00
Range	28.00	39.00
Means	3.95	62.10
Std.Deviation	8.61	13.23
Variance	74.15	175.25

A hypothesis test was conducted using a paired t-test with a 95% confidence level to test whether this increase in average is statistically significant. The characteristics of this t-test were determined from the normality test and homogeneity test of the pretest and posttest data (Santoso, 2014). The results of data normality using the Shapiro-Wilk test with the help of SPSS 26 are obtained, as shown in Table 3.

Table 3. Data Normality Test Results

	Shapiro-Wilk			Information
	Statistic	df	Sig.	
Pretest	0.926	20	0.128	Data is not normally distributed
Posttest	0.916	20	0.082	Data is not normally distributed

From the Shapiro-Wilk normality test, the significance value of the pretest was 0.128, while the posttest was 0.082. sig value. The pretest and posttest sig value that greater than the value of = 0.05. It means that the pretest and posttest data are not normally distributed. So, one of the assumptions of normally distributed data on both tests is not met. In addition to the normality of the data, the homogeneity of the pretest and posttest data also needs to be known. The results of the data homogeneity test on the pretest and posttest values using Levene's Test can be seen in Table 4.

Table 4. Data Homogeneity Test Results

Levene's Test for Equality of Variances	F	df	Sig.	Information
6.578	39.34	38	0.014	Data Homogeny

Based on the results of the homogeneity test of the pretest and posttest data, the significance value was 0.014. This signature value is smaller than the value of = 0.05, so it can be stated that the pretest and posttest data distribution is not homogeneous. Based on the results of the normality test and homogeneity test above, it can be concluded that one of the assumptions of the parametric test is not met. Therefore, the follow-up test was non-parametric, namely the Mann-Whitney test. The results of the analysis of the research hypothesis can be seen in Table 5.

Table 5. Mann Whitney Test

	Pretest-Posttest
Mann-Whitney U	30.5
Wilcoxon W	204.5
Z	-4.6
Sig (2-tailed)	0.000

Table 5 shows a U value of 30.5 and a W value of 204.5. When converted to a Z value, the magnitude is -4.6. Sig value or p-value of 0.000 <0.05. If the p-value < critical limit = 0.05, then there is a significant difference between the two test groups. It can be stated that there is a statistically significant difference between the pretest and post-test scores of the MGMP Science teachers in Pesisir Selatan districts. This means that Bimtek for develop Integrated Science worksheets based on scientific literacy can significantly improve science teachers' competence in the Pesisir Selatan district.

From the results of the research above, two things can be explained, namely: 1) the percentage increase in the competence of science teachers in develop scientific literacy-oriented worksheets is 23%, 2) the increase in science teacher competencies in develop scientific literacy-oriented worksheets occurs significantly with a 95% confidence level.

First, science teachers who are members of the Science MGMP of Pesisir Selatan districts who participate in Bimtek activities show a change in knowledge for the better, with an increase of 23%. Before the Bimtek activities, science teachers needed to understand scientific literacy and how to develop teaching materials, one of which was the scientific literacy-oriented worksheet. However, after the Bimtek activities, science teachers' knowledge increased, as seen from the average score from the pretest to the posttest. Asrizal et al. (2020) stated that Bimtek activities in the form of mentoring are effective in increasing the competence of activity participants, which in this case are science teachers in Pesisir Selatan districts.

Second, when viewed from the statistical significance obtained, the Bimtek activities carried out for science teachers at MGMP Pesisir Selatan districts significantly increased teacher competence in developing scientific literacy-oriented worksheets (Rubini et al., 2016). Bimtek activities positively motivate teachers to develop innovative teaching materials (Sari et al., 2020). Bimtek activities in the form

of mentoring help activity participants understand the essence and manufacture of teaching materials in the form of Integrated Science Student Worksheet based on scientific literacy (Sopiah, 2019).

Conclusion

Technical guidance (Bimtek) on developt Integrated Science Student Worksheet based on scientific literacy can improve the competence of science teachers in implementing the Merdeka Curriculum. Based on the results of data analysis and discussion, it is known that the average score of the science teacher's post-test is higher than the average pre-test score. The mean score for the science teacher's pretest was 39.95, while the mean score for the science teacher's posttest was 62.10. The percentage of increasing the competence of science teachers in develop Integrated Science worksheets oriented to scientific literacy is 23% with satisfactory criteria.

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