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THE EFFECTIVENESS OF THE LOCAL KNOWLEDGE-BASED MODULE (LKBM) TO IMPROVE STUDENTS' SCIENTIFIC LITERACY AND THINKING SKILLS

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ABSTRACT

Scientific literacy is an essential 21st-century skill that students must master. Scientific literacy is the proficiency to engage with scientific ideas and knowledge that shapes the student's ability to interpret and evaluate data within scientific inquiry and make decisions regarding natural change, human activities, and technology. In addition to scientific literacy, thinking skills are crucial in the current era. Thinking skills help students solve social, scientific, and practical problems. Therefore, the current research objective is to test the effectiveness of the local-based knowledge module as a learning media to enhance student scientific literacy and thinking skills in Kupang Regency. 78 elementary school students in Kupang, Indonesia, were involved. They were selected based on the random sampling method and divided into experimental and control groups. The data were collected before using the module, during the use of the module, and after using the module. The instrument used to collect the data was tested for validity and reliability with expert validation. The collected data was then analyzed with SPSS 16 package software. Descriptive analysis and MANOVA were performed. The results indicate that the students' average scores in scientific literacy and thinking skills are enhanced after they use the module. It is emphasized by the significance of the MANOVA analysis, which indicates the difference in score between the group of students who use the local-based knowledge module and those who do not. Based on the results, the module effectively enhances students' scientific literacy and thinking skills. Therefore, this module can be used by teachers at the learning level to improve their scientific literacy and thinking skills.

Keywords: local knowledge; scientific literacy; thinking skill

INTRODUCTION

Scientific literacy is one of the essential 21st-century skills students must master (Winarni et al., 2020). Scientific literacy is the proficiency to perform with scientific ideas and knowledge that shapes students' ability to interpret, evaluate data in scientific investigations, and make decisions related to changes in nature, human activities, and technology (Ardiyanti et al., 2019). Scientific literacy teaches students to read and critically understand the content (Ristanto et al., 2017). It means that students do not only understand the biological concept but also implement and understand the implementation of the biological content in real-life situations. As defined by Roberts and Bybee (2014), the component of scientific literacy learning is to make decisions

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regarding the change in human attitude and environment. Furthermore, Valladares (2021) argues that the concept of scientific literacy learning has changed from memorizing scientific ideas to the risk and impact of science on society and the role of science in social change. Therefore, scientific literacy has become the parameter in determining the human development index (Bröder et al., 2017). Thus, there is a need to enhance the student's scientific literacy of all ages, including elementary school students.

According to Hamna and Bk (2022), improving students' scientific literacy is essential because it relates to their life skills. However, based on the PISA (Programme for International Student Assessment), Indonesian students' scientific literacy still needs to improve. Indonesia was ranked 57 among 67 countries in PISA 2009, 64 among 65 countries in PISA 2012, and 64 among 72 countries in PISA 2015 (Winarni et al., 2020). In general, Indonesia ranked 72 out of 77 countries (Adriyawati et al., 2020). Therefore, according to Kelana (2018), Indonesian students' scientific literacy is low and still below the 500 benchmark given by PISA. Concerning the lower scores of Indonesian students in TIMSS (Trends in International Mathematics and Science Study) and PISA, there is a need to enhance the students' literacy. This is because scientific literacy has become an essential subject to be mastered by Indonesian students to compete in the current century (Sidiq et al., 2021).

According to Ni'mah (2019), one of the skills associated with scientific literacy is thinking skill. It is because scientific literacy shapes students' scientific knowledge and ability to solve real-life problems (Vieira & Tenreiro-Vieira, 2014; Winarni et al., 2020). Abidin et al. (2017) also state that scientific literacy can enhance students' thinking skills by enhancing their overall knowledge. In scientific literacy, students are taught to describe an object, ask questions, and use critical thinking to analyze the latest scientific knowledge, which then formulates their logical and thinking skills (Fakhriyah et al., 2019; Maslihah et al., 2020; Hamna & Bk, 2022). In their research in Indonesia, Sutiani et al. (2021) found that implementing the developed science model proved to enhance students' critical thinking, which is classified as very good in the range score of 72–97%. It is commonly known that good thinking skills are essential for students to solve problems (Syawaludin et al., 2019). Research by Kwangmuang et al. (2021) shows that students with higher thinking skills probably have higher learning outcomes. High thinking skills, such as critical thinking, will help students solve their social, scientific, and practical problems (Mahanal et al., 2019; Kardoyo et al., 2020). Sarwanto et al. (2021) also state that high thinking skills are among the most needed and fundamental skills for students to compete in the 21st century. It indicates that a high level of thinking skills is integrated into students' academic conditions and real-life problems.

Based on the explanation above, thinking skills are related to scientific literacy. In Indonesia, therefore, students have low scientific literacy, followed by low thinking skills. Research conducted by Leasa et al. (2021) involving 161 elementary school students in Maluku, Indonesia, reveals that students' creative thinking skills are very low and require further learning improvement to enhance their thinking skills. Furthermore, several studies have concluded that the thinking skills of Indonesian students at all levels of education are categorized as low (Asyari et al., 2016; Mahanal et al., 2016; Marlina et al., 2016; Fuad et al., 2017; Setiawati & Corebima, 2017). Moreover, according to Hamdu et al. (2020), the quality of Indonesian students' thinking skills is manifested through the results of International assessments, such as TIMSS and PISA. This is because the test basically explores students' thinking skills, such as critical thinking. Hamdu et al. (2020) argue that no Indonesian students perform well on the PISA test. Therefore, students' thinking skills need to be emphasized.

This research highlights two problems faced by Indonesian students, namely the low levels of their scientific literacy and thinking skill scores. One of the solutions to the issues is the integration of local knowledge-based learning into classroom activities. This has been proved by several studies in Indonesian contexts. Hernawati et al. (2019) carried out research to explain the reading skills of Indonesian undergraduate students through project-based learning experiences using local materials. The research suggests that the students' experiences with project activities considerably impact their literacy competencies, particularly in describing scientific phenomena, designing scientific investigations, and interpreting scientific data. Hairida and Junanto (2018) examine the effectiveness of performance assessments for local potential-based learning on environmental pollution. The research concludes that performance assessments based on local potential can enhance students' scientific literacy. Atmojo et al. (2019) conducted research to improve the scientific literacy and science character of Indonesian students through learning material

integrated with local potential, known as ethnoscience. The research concludes that using ethnoscience materials improves students' scientific literacy with a gain score of 0.81, while the average student's character score is >70%. Based on the research above, the use of local knowledge-based learning is successful in enhancing Indonesian students' scientific literacy levels. Furthermore, Dewi et al. (2019) argue that Indonesian students' low scientific literacy index is related to the lack of attention focused on the social and cultural environment in their respective fields.

Hairida and Junanto (2018) state that inappropriate learning material is one of the causes of students' scientific literacy. Dewi et al. (2019) find that there is a need for a curriculum to develop chemistry literacy, the skill of chemistry lectures to leverage local potential in their locations, and modules addressing the fundamental concepts of chemistry. It indicates the need for the module, which covers the local knowledge of the students. According to Rumansyah et.al (2023), the recommended learning approach in Indonesia is ethnoscience, which combines the student's culture, condition, and science. It relates to the scientific literacy concepts, where the students emphasize practicing and implementing scientific concepts in real-life situations. Through cultural-based education, students can efficiently conduct direct observation, identify scientific problems, and draw conclusions from natural conditions because the material has already been integrated with their real-life conditions (Nurcahyani et al., 2021). Dewi et al. (2019) emphasize two aspects of learning for improving students' scientific literacy by applying a product learning approach and contextual learning, where the teacher mainly integrates the learning materials with the students' environment. The need to provide learning materials is based on local knowledge in the students' respective fields.

The current research is conducted in Kupang, Indonesia since the data have shown the low quality of Kupang students in terms of scientific literacy and thinking skill. Aiman et al. (2020) report the low level of scientific literacy among students in SD Oeba 2, Kupang, Indonesia. They find that 60% of students do not achieve the scientific literacy standard of 65, while only 40% have a scientific literacy score above 65. They also report the low level of students' critical thinking skills. Lestari et al. (2019) observed junior high school students in Kupang, Indonesia. They found that the students needed more ability to argue and could not interpret issues in the learning process, indicating their lack of critical thinking. Regarding scientific literacy, they report that the students need to help articulate hypotheses clearly or make and justify reasonable forecasts. In addition, Fointuna (2021) applies the fuzzy logic designer on MatLab in his research and suggests a substantial difference between the mean, median, and ideal maximum scores. Most respondents score significantly lower than the recommended ideal maximum scores. The data shows that most public middle school students in Kupang score close to the mean and median, indicating a lack of proficiency in mathematics literacy. A few research mentioned above confirm the low level of students' scientific literacy and thinking skills. Therefore, research on this place, which constructs the module and improves the students' scientific literacy and thinking skills, is necessary.

In response to this case, this research aims to provide modules that integrate Kupang local-based knowledge, namely Faloak plants, so that students in Kupang can respond to the current problem of students in scientific literacy and thinking skills in the respective regions. According to Jannah et al. (2022), Faloak plants are medicine plants across East Nusa Tenggara, including in Timor Tengah Utara District, Kupang City, Indonesia. Faloak is traditionally boiled, brewed, and consumed to cure various diseases, as believed (Lalong et al., 2022). For generations, Kupang society has used Faloak plants to cure hepatitis (Siswadi et al., 2016). Furthermore, this plant is used to cure dengue, wound treatment, eye pain, insect bites, hepatitis, typhus, and stamina enhancement (Uslan et al., 2020; Riwu et al., 2022). Since the plant is used as medicine, it becomes familiar and is increasingly used year after year by the local people of Kupang (Uslan et al., 2020). This means the plant is integrated and has become a daily need for the Kupang people.

According to Irfandi et al. (2023), everyday life cannot be separated from life activities, so the learning module implemented for students in Kupang must relate to the cultural anthropological approach. This approach may strengthen the typical Kupang plants juxtaposed by the learning module so that the students from the Kupang Regency can easily understand the materials. It demonstrates the importance of generating modules based on Faloak plants. Additionally, the urgency of providing the module integrating Faloak plants is: 1) Students' critical thinking in Kupang is less, where only 40% of the students attain the standard of literacy benchmark (Aiman et al., 2020). Mainly, they lack the ability to argue and interpret issues (Masykuri, 2019). 2) By using

local-based knowledge, a module is proven to be effective in improving students' thinking skills (Kurniawan & Syafriani, 2021) and students' scientific literacy (Setiawan et al., 2017). 3) The utilization of the Faloak plants as the learning material in the module is scarce. Based on the literature review conducted in several reputable journals, research regarding Faloak plants in Kupang is restricted to Faloak plants as the curing disease (Dean et al., 2019; Siswadi et al., 2021) and the anatomy and morphological aspects of the plants (Asmiati et al., 2019; Uslan et al., 2020; Jannah et al., 2022). Therefore, integrating the Faloak plant as the learning material is new and has become the originality of the current research.

Other than that, the context and educational condition in Kupang emphasizes the need for module development to support students' scientific literacy and thinking skills. Uslan et al. (2020) reported that many schools in Kupang do not have books, pencils, pens, or even adequate modules for teaching. Therefore, providing the appropriate module can facilitate the teaching and learning process in this area, mainly in scientific literacy and thinking skills. Abdussamad and Aiman (2018) report that less support from parents for education decreases students' motivation to learn in Kupang. In this case, a module integrating local-based materials such as the Faloak plant can trigger students to learn and enhance their motivation (Tazhitova et al., 2022). The integration of Faloak plants as learning material in this research is because of their suitability as learning material in science, which has already been confirmed by Lestari (2019). She suggests the appropriateness of the Faloak plant as learning material for morphology and anatomy subjects. The module can be one of the learning materials that can be used to teach the science subject. This can be an additional source of learning material in schools in Kupang.

This research intends to test the module as valid and appropriate for students' thinking skills and scientific literacy based on the Faloak plant provided. It is crucial since, according to Hermawan et al. (2022), the sociocultural aspect, such as the typical plants of the region, can typically improve literacy in the region. Furthermore, similar research objectives and methodological approaches have been conducted previously in other regions of Indonesia. Sanjayanti et al. (2022) analyze the effectiveness of the science learning module with local Balinese wisdom to improve junior high school students' character and scientific literacy in Bali, Indonesia. This research employed a descriptive analysis and MANOVA test, confirming the appropriateness of the module. Muslih et al. (2022) developed a science e-module on the function of living organs to improve elementary school students' scientific literacy in Simomulyo, Indonesia. Ramdiah et al. (2020) examine the effectiveness of the Biology learning module based on the local wisdom of South Kalimantan, Indonesia. This research conducted a one-way analysis of covariance (ANCOVA) test to investigate whether applying local wisdom-based learning significantly improved students' learning outcomes. Innatesari et al. (2020) use the MANOVA analysis to test the effectiveness of a module on students' scientific literacy. Previous research reveals that the analysis of modules based on local knowledge has been validated in other regions in Indonesia, and the use of the multivariate level analysis is common. However, no module has been tested for effectiveness in improving the performance of elementary school students in Kupang, Indonesia. Therefore, the current research fills the gap in providing and testing the local knowledge module for elementary school students in Kupang, Indonesia, by utilizing the multivariate analysis as done by previous research.

METHODS

The current research aimed to test the local knowledge module of the Faloak plant to determine whether the module can enhance students' scientific literacy and thinking skills. Researchers conducted quasi-experimental research with a single-factor independent group design to achieve this objective.

The total number of students involved in the current research was 78 students selected based on the random sampling method. In terms of the population, the total number of elementary schools in East Tenggara was ten schools. SD Oeba 3 Kupang and SD Oeno were selected as the research sites because both schools implemented the newest curriculum, *Kurikulum Merdeka* (Emancipated Learning). Moreover, both schools obtained the minimum criteria score of 80 in science subjects. In terms of the sample, the random sampling method was employed to determine the number of samples for the current research. The researchers determined which class was selected as the representative of the school. All classes had a similar opportunity to be selected. In this case, the researchers conducted the lottery to select two classes for experiment and control classes. As a result, 78 students were divided into control and experimental classes selected for the current research. Detailed information about the participants can be seen in Table 1.

Table 1. Participant`s Information

School	Grade	Male	Female	Total
Oeba 3	IVA	8	11	19
	IVB	7	12	19
Oeno	IVA	10	10	20
	IVB	8	12	20
Total		33	45	78

Table 1 provides information about the participants. There are two classes in Oeba 3, namely IVA and IVB, and there are two classes in Oeno, namely IVA and IVB. In terms of gender, there were 33 male students and 45 female students who took part in this research. The researchers conducted an equality test by looking at students' midterm scores to highlight the equality between experimental and control classes. The purpose of the t-test was to determine whether or not the midterm test achievement scores of the experimental and control classes differed. The result indicated that students had equivalent abilities because they had significant scores, as well as by noting a high level of equality.

The participants were divided into two groups: the control group (39 students) and the experiment group (39 students). The experiment group was taught using the local-based knowledge module, and the control group was not. The experimental group was given the pre-test, middle test, and post-test to see whether there was an increase in students' scientific literacy and thinking skills before and after using the module. The control group was also given the post-test to compare the results of the group that used the local-based knowledge module with those that did not.

The instrument used to collect data in the pre-test, middle-test, and post-test was examined for its validity and appropriateness for the actual research through expert validation. The expert considered several aspects when examining each item of the instrument. Regarding scientific literacy, the instrument should cover functional, civic, and cultural literacy. Regarding thinking skills, the instrument should cover analysis, synthesis, problem-solving, and evaluation abilities. The expert rated the instrument based on these criteria. The result of expert validation can be seen in Table 2.

Table 2. Experts' Validation

Experts	Item relevancy	Instrument Items	
		Scientific literacy instrument	Thinking skill instrument
Experts 1	Very Relevant item	1, 2, 3, 4, 5, 6,7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22
	Not relevant items	-	
Experts 2	Very Relevant item	1, 2, 3, 4, 5, 6,7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22
	Not relevant items	-	

According to Table 2, the two experts agreed that all items given were valid for the current research. Additionally, the researchers examined the validity of each item through item analysis. Item analysis was conducted by correlating the item test with the total score, the sum of the scores. The determination of item validity was measured through dichotomy-shaped test particles using the point biseral correlation formula. The result can be seen in Table 3.

Table 3. Item Analysis

Scientific literacy instrument			Thinking skill instrument	
No	**r value**	**Description**	**r value**	**Description**
1	0.25	Valid	0.30	Valid
2	0.26	Valid	0.37	Valid
3	0.25	Valid	0.30	Valid
4	0.27	Valid	0.31	Valid
5	0.49	Valid	0.25	Valid
6	0.36	Valid	0.24	Valid
7	0.26	Valid	0.25	Valid
8	0.41	Valid	0.38	Valid
9	0.29	Valid	0.32	Valid
10	0.29	Valid	0.31	Valid
11	0.51	Valid	0.26	Valid
12	0.25	Valid	0.34	Valid
13	0.29	Valid	0.26	Valid
14	0.56	Valid	0.34	Valid
15	0.38	Valid	0.26	Valid
16	0.50	Valid	0.45	Valid
17	0.25	Valid	0.27	Valid
18	0.25	Valid	0.24	Valid
19	0.39	Valid	0.38	Valid
20	0.31	Valid	0.25	Valid
21	0.44	Valid	0.04	Not Valid
22	0.24	Valid	-0.12	Not Valid
23	0.43	Valid		
24	0.58	Valid		
25	0.37	Valid		
26	0.24	Valid		
27	0.51	Valid		
28	0.26	Valid		
29	0.42	Valid		
30	0.31	Valid		

The item analysis results indicated that 30 items of scientific literacy were all valid, and among 22 items of thinking skills, two were invalid. The invalid items were then excluded and not used in the current research. Therefore, the current research used 30 items of scientific literacy and 20 items of thinking skills to measure students' scientific literacy and thinking skills.

Here are the procedures for the research. Firstly, the researchers gave the pre-test to the experiment group, and then the group was given the treatment, namely the learning activities using the local-based knowledge module. In implementing the module, the researchers gave the students a middle test to examine the increase in their scientific literacy and thinking skills. After implementing the module, the researchers also gave the students a post-test to examine enhancing their scientific literacy and thinking skills. At this stage, the data were analyzed through descriptive analysis. According to Almquist et al. (2019), descriptive statistics such as the mean, median, and modus can be used to examine the central tendencies of the data, which are defined as the measures of the location of the middle in a distribution. That tendency will be the indicator of the typical score within the data, which provides some insight into the basic characteristics of the data (Mishra et al., 2019).

Therefore, a descriptive statistic, such as the mean, was used for the current research to understand and compare the students' tendencies concerning their scientific literacy and thinking skills. In this case, the researchers compared students' mean scores before using the module, during the use of the module, and after using the module to determine the effectiveness of the module on the enhancement of the students' scientific literacy and thinking skills examined.

Secondly, the researchers collected data from the control group, which consisted of students who did not use the local-based knowledge module. Like the experiment group, the data were collected in the pre-test, middle, and post-test. The data collected was then compared with the data gained from the experiment group to see the difference in scientific literacy and thinking skills between the students who used the module and those who did not. To see the score comparison, a MANOVA analysis was performed. Mainly, MANOVA is an analysis that tests the difference between the mean of the group and the underlying unobserved latent variable (Warne, 2014). Before MANOVA, prerequisite tests such as the normality and homogeneity tests should be performed. The normality test in this research used the Shapiro-Wilk test. The research data are distributed normally if the probability value is greater than the significance level of 0.05, and vice versa. The data is not normally distributed normally if the probability value is < 0.05. The researchers also tested the homogeneity of the variance. The homogeneity test was performed to ensure that the difference in the hypothesis testing occurred due to group differences. Jamshidian et al. (2014) state that a homogeneity test is performed to determine whether the variable matrix is similar. The homogeneity test of the variant matrix was done using the Barlet test. When the Barlet value is significant, the variant of the variable is dependent, so the hypothesis is rejected. If the significance value of the Barlet test is greater than 0.05, then the zero hypothesis is accepted, which means that the variance matrix of the dependent variable is the same so that the MANOVA analysis can be continued. Hypothesis testing was performed using the program SPSS 16.00. The test criteria is that if the values of F-Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root yield a significant number less than 0.05, then the zero hypothesis is rejected, and in other cases, the hypotheses are accepted (Trisnayanti et.al, 2020). In this research, the MANOVA was intended to compare the difference between the experiment and control groups, so the module's effectiveness on the students' scientific literacy and thinking skills was examined.

RESULTS AND DISCUSSION

The researchers conducted two analyses to examine the effectiveness of LKBM (Local knowledge-based module) in enhancing students' scientific literacy and thinking skills. Firstly, the researchers compare the pre-test, middle-test, and post-test results, and secondly, the researchers compare the control and experiment groups.

1. The Comparison of Pre-Test, Middle Test, and Post-Test on Students' Scientific Literacy. The comparison between the pre-test (before using the module), the middle test (during using the module), and the post-test (after using the module) of students' scientific literacy score results can be seen in Table 4.

Table 4. The Score Comparison of Students' Scientific Literacy

"Description		'Mean"	Median"	"Modus	Variant	Std. Deviation"
Scientific Literacy	Pre-test	73.84	74.00	65	34.918	5.909
	Mid-test	76.47	77.50	78	15.819	3.977
	Post-test	81.00	81.00	75	16.889	4.110

Table 4 displays the comparison between the pre-test and the middle test. The results show that the average score of the student pre-test is 73.84, the median is 74.00, the modus is 65.00, and the standard deviation is 5.909. The scores increase in the middle test where the average score of students in the middle test is 76.47, the median is 77.5, the modus is 78, and the standard deviation is 3.977. Furthermore, the score increases in the post-test test where the average score of students' scientific literacy is 81.00, the median is 81.00, the modus is 75, and the standard deviation is 4.110. According to the result, there is an increase in the mean, where the mean in the pre-test is 73.84, increasing to 76.47 in the middle test, and increasing to 81.00 in the post-test. It means there is an increase in students' scientific literacy after using the LKBM of the Faloak plant.

2. The Comparison of Pre-Test, Middle Test, and Post-Test on Students' Thinking Skills. The comparison between the pre-test (before using the module) with the middle test (during using the module) and post-test (after using the module) of students' thinking skill scores can be seen in Table 5.

Table 5. The Score Comparison of Students' Thinking Skills

"Description"		'Mean"	Median"	"Modus	Variant	Std. Deviation"
Thinking Skills	Pre-test	75.63	76.00	75	12.246	3.499
	Mid-test	76.26	76.00	78	14.399	3.794
	Post-test	81.42	80.00	80	16.813	4.100

Table 5 shows the results of the students' pre-test, middle-test, and post-test of their thinking skills scores. The average score of students' pre-tests is 75.63, the median is 76, the modus is 75, and the standard deviation is 3.499. The scores increase in the middle test where the average score of students in the middle test is 76.26, the median is 76, the modus is 78, and the standard deviation is 3.794. Furthermore, the scores increase in the post-test, where the average score of students' post-tests is 81.42, the median is 80, the modus is 80, and the standard deviation is 4.100.

Based on the results, there is an increase in the mean score of the students' thinking skills, where the mean score in the pre-test is 75.63, increasing to 76.26 in the middle test and 81.42 in the post-test. It means there is an increase in the students' thinking skill scores after using the local-based knowledge module of the Faloak plant.

The researchers conducted a multivariate test to compare the control and experiment group results. Before that, the researchers tested the data normality and the homogeneity of the dataset. The normality test in this research used the Shapiro-Wilk test. The research data is distributed normally if the probability value is greater than the significance level of 0.05 and vice versa. The data is not normally distributed if the probability value is < 0.05. The result of the normality test is displayed in Table 6.

Table 6. Test of Normality

Variables	Test	Shapiro-Wilk			Description
		Statistic	df	Sig.	
Scientific Literacy	Pre-test Scientific Literacy in Oeba	.942	19	.291	Normally distributed
	Mid-test Scientific Literacy in Oeba	.920	19	.113	Normally distributed
	Post-test Scientific Literacy in Oeba	.916	19	.097	Normally distributed
	Pre-test Scientific Literacy in Oeno	.826	20	.002	Not normally distributed
	Mid-test Scientific Literacy in Oeno	.938	20	.218	Normally distributed
	Post-test Scientific Literacy in Oeno	.955	20	.441	Normally distributed
Thinking Skill	Pre-test Thinking Skill in Oeba	.904	19	.057	Normally distributed
	Mid-test Thinking Skill in Oeba	.957	19	.521	Normally distributed
	Post-test Thinking Skill in Oeba	.915	19	.093	Normally distributed
	Pre-test Thinking Skill in Oeno	.883	20	.020	Not normally distributed
	Mid-test Thinking Skill in Oeno	.937	20	.213	Normally distributed
	Post-test Thinking Skill in Oeno	.900	20	.042	Not normally distributed

Based on the results of the Shapiro-Wilk test, most of the data are normally distributed. Several data points with 'not normally distributed' are post-test thinking skills in Oeno, pre-test thinking skills in Oeno, and pre-test scientific literacy in Oeno. Furthermore, the homogeneity test uses Box's and Levenen's tests. The result can be seen in Table 7.

Table 7. Homogeneity Test

Box's Test of Equality of Covariance Matrices[a]		**Levene's Test of Equality of Error Variances[a]**					
Box's M	**52.950**	**Variable**	**F**	**df1**	**df2**	**Sig.**	**Sig. or Not Sig. (n.s)**
F	2.723	Scientific literacy	6.948	3	74	.200	Sig.
df1	18	Thinking skill	4.598	3	74	.015	n.s
df2	19241.174						
Sig.	.028						

Table 7 shows that the significant figure produced by Box's M test and Levene test is greater than 0.05. This means that the variance matrix of the students' scientific literacy variable and the thinking skill are homogeneous, and the MANOVA analysis can be continued. The MANOVA analysis is used because it helps the researchers ensure the power is different between the dependent and independent variables, considering the technical relation between the variables, the pattern of population means, and the real distribution of the measure. Furthermore, MANOVA seems appropriate for examining the difference between the control and experiment groups. This method works well, especially with emergent-variable systems. MANOVA creates linear discriminant functions from the dependent variables. Measures are weighted based on their unique contribution to discrimination between groups. Therefore, the difference between groups is clear. The result of the MANOVA analysis can be seen in Table 7.

Firstly, the researchers executed a multivariate analysis of the students' scientific literacy between the students who use the local-based knowledge module of the Faloak plant and the students who do not use the module. The results of the analysis can be seen in Table 8.

Table 8. Hypothesis Test of Scientific Literacy

Sources	**Dependent variable**	**JK**	**Db**	**RJK**	**F**	**Sig**	**Sig. or Not Sig. (ns)**
Between	Scientific literacy	1054.839	3	351.613	11.630	<0.05	Sig.
Inside	Scientific literacy	2237.276	74	30.233	-	-	
Total	Scientific literacy	463447.000	78	-	-	-	

With an F score of 11.630, indicating $p < 0.05$, Table 8 compares the scientific literacy of students completing the LKBM to students pursuing conventional learning. In summary, the hypothesis (Ha) is accepted, while the zero hypothesis (H0) is rejected. It indicates that students who employ the LKBM in their learning process have a significantly higher level of scientific literacy than students who use a conventional learning approach. Thus, the Faloak plant's locally based knowledge module significantly affects the students' scientific literacy.

Next, the researchers conducted a multivariate analysis of thinking skills between the students who use the local-based knowledge module of the Faloak plant and the students who do not use the module. The results of the analysis can be seen in Table 9.

Table 9. Hypothesis Test of Thinking Skills

Sources	Dependent variable	JK	Db	RJK	F	Sig	Sig. or Not Sig. (ns)
Between	Thinking skill	822.985	3	274.328	11.600	<0.05	Sig.
Inside	Thinking skill	1750.003	74	23.649	-	-	
Total	Thinking skill	476969.000	78	-	-	-	

The thinking skills of students using the Local Knowledge-Based Learning Module (LKBM) and those applying conventional learning, obtaining a score of 11.600 with a significant upgrade value of $p<0.05$, are shown in Table 9. This suggests that the alternative hypothesis (Ha) is accepted, and the zero hypothesis (H0) is rejected. As can be seen from the multivariant analysis results, there is a substantial difference in the thinking skills of the students who follow the learning process using the LKBM compared to those who utilize conventional learning. This indicates that the local knowledge module of the Faloak plant significantly influences the students' thinking skills.

The present research aims to evaluate how effectively the local knowledge-based module enhances students' scientific literacy and thinking skills. The pre-test, middle-test, and post-test results are compared using descriptive statistics. A MANOVA is also performed to compare the control and experiment groups. There are statistically significant differences in the mean, median, pre-test, middle test, and post-test in implementing the module. Furthermore, the results of the MANOVA analysis support the alternative hypothesis, indicating that, based on the results of the multivariant analysis, students who follow the learning process with the LKBM differ significantly from students who use conventional learning in terms of their scientific literacy and thinking skills.

The usefulness of this module in fostering students' scientific literacy and thinking skills might be caused by the local-based material, namely the Faloak plant, insisted in the module. The utilization of local-based knowledge in enhancing students' scientific literacy is proved by other researchers, such as Hernawati et al. (2019), Hairida and Junanto (2018), Babaci-Wilhite (2017), Saefullah et al. (2017), Hastuti et al. (2020), and Zahroh et al. (2022). The usefulness of local-based knowledge on thinking skills is also proved by Tandiseru (2015), Suardana et al. (2018), Putri and Aznam (2019), Hadi et al. (2019), Aminatun et al. (2022), and Yuenyong (2017). Numerous researchers have proved the significant impact of local-based knowledge on students' scientific literacy and thinking skills, which supports the current research results. The previous studies have indicated the valid results of the current research. Theoretically, the local-based knowledge will captivate the students' interest in exploring facts and phenomena since it relates to their regional identity (Dewi et al., 2019). Throughout the local-based knowledge, the students will experience the contextual experience that triggers their scientific thinking and thinking skills (Arfianawati et al., 2016). As discussed in the current research, the students using the LKBM will contextually learn the material with curiosity and excitement. As a result, it triggers their scientific literacy and thinking skills.

Besides that, in the context of scientific literacy and thinking skill intervention theory, the current research has helped fill the gap in enhancing the students' scientific literacy and thinking skills. It is because Shaw et al. (2014) state that two challenges faced by educational intervention in students' scientific literacy are improving the teaching and learning process and the preparation of the teacher. The current validated module can assist the students' teaching and learning by guiding the learning process through the scientific activities provided in the module. According to Crawford (2014), enhancing students' science inquiry requires hands-on activities, active thinking, and discourse activities around scientific inquiry. In this case, integrating the local-based knowledge material for the students allows them to interact with scientific inquiry. The material covers the scientific object, namely the Faloak plants, so the scientific procedure is covered.

The results of this research confirm the appropriateness of the module and its ability to enhance students' scientific literacy and thinking skills. This is significant since, as noted in the location of this research, students' scientific literacy and thinking skills are categorized as low. As Uslan et al. (2020) found, only 50% of elementary school students master basic reading, counting, and writing skills. Aiman et al. (2020) report that only 40% of the students achieve the literacy standard given by the Indonesian government. Furthermore, the students in the area are known to

have low levels of thinking skills, manifested through low Indonesian PISA and TIMS scores (Adriyawati et al., 2020; Herman et al., 2022; Winarni et al., 2020). According to Prawita et al. (2019), the low level of Indonesian students' thinking skills can be seen from the TIMS and PISA scores. It occurs because the assessment measures two aspects, namely the subject and cognitive domain. The concern on students' thinking processes is reasoning, analyzing, evaluating, and creating. In addition, Kurniati et al. (2021) reveal that 70% of Indonesian students can answer critical thinking questions in the low category. Therefore, using the module in this area is essential to improve students' thinking skills. Through this research, the module has been proven to enhance students' scientific literacy and thinking skills before and after using it.

Furthermore, this module is expected to enhance Indonesian International assessment scores, such as TIMSS and PISA. The teachers, as the main facilitators in the class, can utilize the module in their learning activity. Irwan et al. (2019) argue that teachers are responsible for enhancing students' thinking skills based on Indonesian ministry regulations. According to Prawita et al. (2019), students' thinking skills, mainly their analytic skills, could be improved through suitable methods and models of teaching as well as suitable material based on their characteristics. Teachers can form higher-order thinking-oriented learning through a module in an environment where students can express ideas, ask questions, and generate ideas (Dewi & Mashami, 2019; Zulaeha et al., 2023). In this case, teachers should be equipped with modules that have proven to enhance students' scientific literacy and thinking skills. Komarudin (2022), in his need analysis, reveals that teachers need modules to improve student's creative thinking. Therefore, the present research findings are significant in providing an appropriate module for improving students' scientific literacy and thinking skills.

The result of the current research would be beneficial references for educational practice and policy. Since local-based knowledge material has been confirmed to be effective in enhancing students' scientific literacy and thinking skills, local-based material can be integrated and utilized as learning material. Policymakers and curriculum developers should consider this material to be included in the teaching and learning process. Furthermore, understanding that each of the regions in Indonesia has its own unique local-based material, the Ministry of Education can suggest the development of modules based on the local-based culture in each region in Indonesia in order to make the learning process effective, enhance students' thinking skills and scientific literacy, and introduce them to their local culture.

CONCLUSION

This present research aims to examine the effectiveness of the local-based knowledge module to improve students' scientific literacy and thinking skills. The data were examined using MANOVA and descriptive analysis. Based on the results of the descriptive analysis, students' scientific literacy increase after utilizing the module, with the mean score rising from 73.84 in the pre-test to 76.47 in the middle test and 81.00 in the post-test. Meanwhile, students' thinking skills increase from 75.63 in the pre-test to 76.26 in the middle test and 81.42 in the post-test following the use of the module. Furthermore, as seen by the results of multivariant analysis, MANOVA analysis demonstrates a significant difference in scientific literacy and thinking skills of students who follow the learning process with the LKBM compared to those using conventional learning. Therefore, the module helps enhance students' scientific literacy and thinking skills. These research results can be used in educational practices that improve students' scientific literacy and thinking skills. Teachers and educational practitioners can utilize this module in their classroom teaching practice. Moreover, the educational policymaker can consider the local-based module or material to be developed in several regions of Indonesia, seeing the impact the local-based material has on scientific literacy and thinking skills and that each region in Indonesia has its own local-based culture. This research fills the gap in the need to provide a module integrating the local knowledge of the Faloak plants for students in Kupang. This seeks to foster students' thinking skills and scientific literacy. This indicates that incorporating this module in the teaching and learning process among Kupang students can enhance their thinking skills and scientific literacy. However, further research needs to be done to gauge any potential additional information regarding the implication of the LKBM in the classroom setting. Therefore, further research is suggested to conduct research on the long-term effects of implementing the module, examine the potential factors that influence the module's effectiveness in enhancing the students' scientific literacy and thinking skills, and investigate the module's applicability in different educational settings.

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