Local Wisdom Oriented-Problem Based Learning Model Assisted by Interactive E-Magazine to Improve Students' Critical Thinking Skills

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Sections Info	ABSTRACT
	Objective: The aim of this investigation is to study and describe a Problem-Based Learning (PBL) model based on local wisdom assisted by interactive magazines to enhance students' critical thinking skills. Method: This study used a quasi-experimental design with a saturated sample technique. The tools employed were observation sheets monitoring both teacher and student activities, critical thinking tests, and a questionnaire. Results: Based on observations results, it was found that teacher and student activities were very good with percentages of 96,64% and 91,96% respectively. According to the t-test, the significance (two-tailed) value was 0.000, which is less than 0.05, leading to the rejection of the null hypothesis (H_0). Therefore, it can be inferred that students' critical thinking skills differ significantly between the experimental and control classes. The category of critical thinking skills was less initially and improved into a critical category after the implementation of local wisdom-oriented problem-based learning assisted by an interactive e-magazine. Moreover, Learning using interactive magazines was also interesting, effective, and practical for students. Novelty: This research specifies the problem given to material or issues related to local wisdom of Malaysia for Indonesian students. Besides, the implementation of the model is assisted by the interactive media to strengthen the effects.

INTRODUCTION

In the 21st century, science and technology advanced so quickly that students needed to acquire a wide range of abilities in order to compete on a worldwide scale (Fuaidah et al., 2020; Kennedy & Sundberg, 2020; Ritonga et al., 2020; Septiani et al., 2020). The skills of the 21st century are meant to master 4C which is a means of achieving life success in society of the 21st Century. As for 4C skills, they are the skills of Communication, Collaboration, Critical thinking and Problem Solving, and Creativity and Innovation. 4C is a soft skill that in its daily implementation is much more beneficial than mastering a hard skill (Arnyana, 2019; Hakim & Rahman, 2023; Riyanto et al., 2024). Therefore, education should equip learners with the ability to cultivate critical thinking skills needed in the challenges of times.

Critical thinking is the activity of thinking about ideas and concepts relating to a particular concept or problem to make careful, comprehensive, and logical decisions from different perspectives. Critical thinking skills help students consider other people's opinions and express their own opinions. Learning in schools aims to train students to improve their skills and ability in searching, processing, and critically evaluating a variety of information (Hasanah et al., 2018; Rosmaini, 2023; Syafitri et al., 2021; Syahdiani et al., 2015).

Observations and interviews were conducted with science teachers at SIKL to assess students' critical thinking skills. From the result of the interview, the learning process still uses the 2013 curriculum with methods of discussion and lecture. The teacher also revealed that they have already used the discovery learning model, similar to the PBL. The learning media used by teachers were slides of power points and students' books. During the interview, the teacher stated that they had done a critical thinking test, but the critical thinking results of the students were still in the "less" category.

The solution to this is to employ problem-based learning (PBL). The learning syntax of PBL can help students become more adept at critical thinking (Mahmudah & Nugraha, 2024; Masrinah et al., 2019). A problem-based learning approach with local intelligence helps students apply their knowledge to real-world situations. Engaging in learning processes can aid students in honing their critical thinking abilities. This problem-solving approach was chosen because sustainable learning in a local intelligence-based PBL learning model allows students to think more creatively and solve problems, be more independent and active, and be more collaborative and responsible (Avitrananda, 2020).

Since science is the methodical discovery of natural phenomena, it is both a process of discovery and a body of knowledge made up of facts, concepts, and principles. Therefore, natural science is a subject that can advance and develop the student's thinking skills to solve problems in everyday life (Adelia & Nasution, 2021; Astawan & Agustiana, n.d.; Tania, 2018).

In this study, the author uses the local wisdom of Kuala Lumpur as the basis of the PBL learning model. Kuala Lumpur is the capital of Malaysia which has a rich cultural, historical, and culinary diversity. Interactive magazines are media that are equipped with digital features such as images, and videos and are said to be interactive because these media are designed with active user responses (Fauzi et al., 2024; Munawaroh et al., 2021; Yasir et al., 2022). Interactive magazines that are very practical and showcase technological developments that are already very advanced. Interactive magazines can enhance the interest and motivation of students in learning because they offer an enjoyable and varied learning experience (Jariati & Yenti, 2020; Kurniawati & Nita, 2018; Wahyuni et al., 2024).

The study aims to analyze the influence of local wisdom-oriented PBL learning models assisted by interactive e-magazines on students' critical thinking skills in additive and addictive materials for eighth-grade SIKL students. It is anticipated that the research will aid in the creation of interactive e-magazines as a creative and successful learning option for enhancing critical thinking abilities in local wisdom oriented PBL. This research is expected to be beneficial to teachers, students, schools, and the community in improving.

RESEARCH METHOD

Using a critical thinking skills test, each class in this quasi-experimental study completes a pretest and posttest. There are two classes involved: the control and the experiment. While the control group employed conventional learning models, such as discovery learning, the experiment class received instruction using a local wisdom-oriented PBL learning paradigm supported by interactive e-magazines. The quasi-experimental design can be seen in Figure 1.
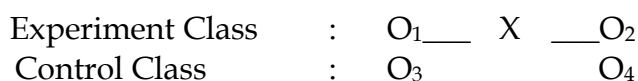
$$\text{Experiment Class} \quad : \quad O_1\_\_\_ \quad X \quad \_\_\_O_2$$
$$\text{Control Class} \quad : \quad O_3_____O_4$$

Figure 1. Research Design

Descriptions;

O_1: Critical-thinking skill test results are shown by the students of the experimental class before being treated, which are expressed by the results of the initial skill test score.

O_2: Critical thinking skill test results are shown by the students of the experimental class after being treated, expressed by the final skill test score

X: The treatment imposed on the experimental class, which is a local wisdom-oriented PBL learning model assisted by interactive e-magazines

O_3: Critical thinking skill test results are shown by the students of the control class before being treated, expressed by the initial skill test score

O_4: Critical thinking skill test results are shown by the students of the control class without being treated, expressed by the final skill test score.

In the experimental class, steps of learning are carried out by a local wisdom-oriented PBL learning model assisted by interactive e-magazines: 1) student orientation on the problem, students can analyze from the image of the food area studied on the interactive magazine 2) organize students to learn, 3) guide individual or group research, students may work on the columns of issues that are presented in interactive magazine 4) create and display the outcomes, 5) students can pose question based on the analysis and evaluation of the problem solving process in an interactive magazine.

The instruments use an observation sheet of teachers' and students' activities, critical thinking skills tests, and the questionnaire of students' responses to the learning media used. The data analysis technique results from observations of teacher's and student activities using the following formula:

$$\% \text{ Execution} = \frac{the\ number\ of\ scores\ obtained\ on\ each\ item}{The\ ideal\ score\ number\ for\ the\ entire\ item} \text{ x } 100\%$$

The percentage of learning attained is subsequently transformed into qualitative data according to the criteria specified in Table 1.

Table 1. Criteria for Assessing Observation Results

Percentage (%)	Category
$80 \leq X \leq 100$	Very good
$60 \leq X \leq 80$	Good
$40 \leq X \leq 60$	Enough
$20 \leq X \leq 40$	Less
$0 \leq X \leq 20$	Very Less

The data analysis technique results in the student's thinking skills using a t-test. before conducting a t-test, it should be tested of assumption to see the normality and

homogeneity of the data. The critical thinking test is in the form of seven reasoned questions. This study uses critical thinking skills indicators of Ennis: 1) Basic Clarification, 2) Bases for a Decision, 3) Inference, 4) Advanced Clarification, and 5) Employ Rhetorical Strategies. The result of each aspect then being analyzed using descriptive statistics by looking at the average critical thinking ability of students categorized by Wasqita (2022) in Table 2.
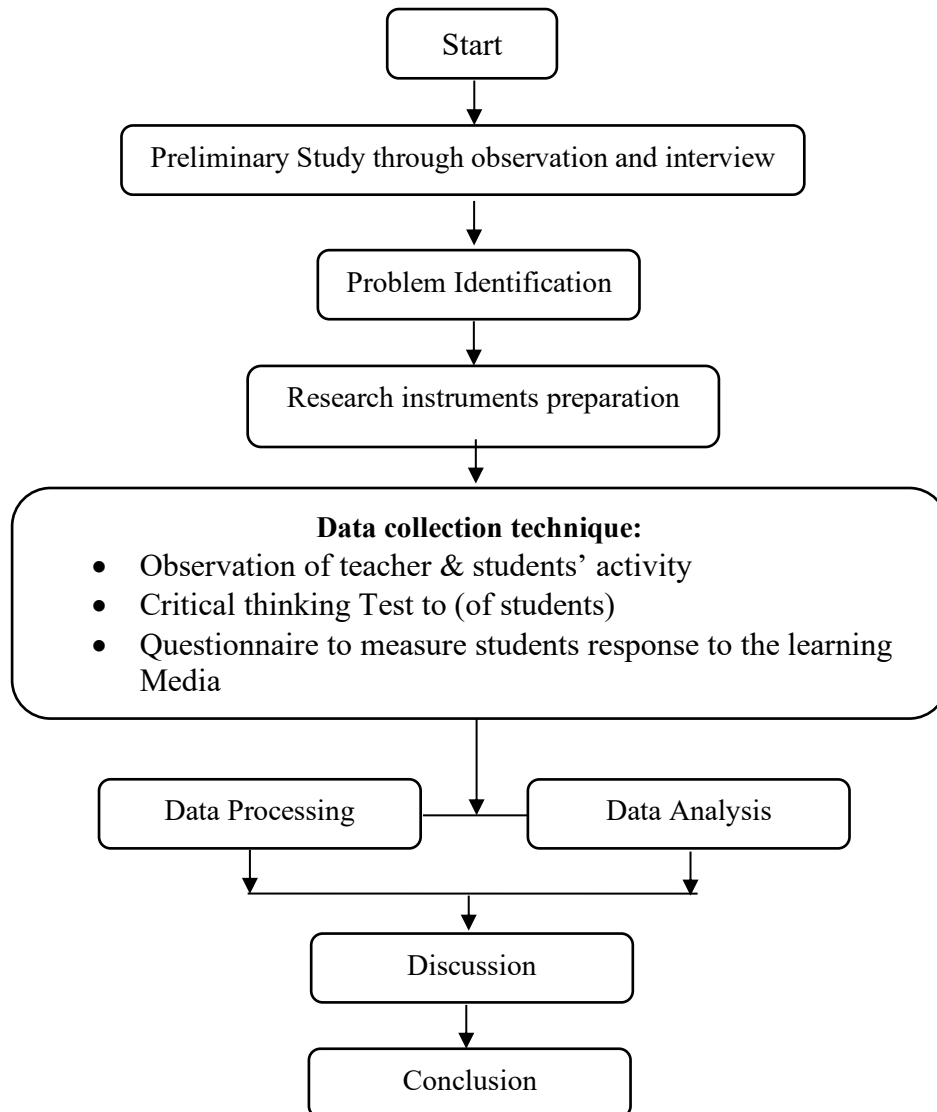
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Data collection technique:

- Observation of teacher & students' activity
- Critical thinking Test to (of students)
- Questionnaire to measure students response to the learning Media

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Figure 2. Steps of research

Table 2. Critical Thinking Skills Criteria

Percentage (%)	Category
81 – 100	Very Critical
61 – 80	Critical
41 - 60	Quite Critical
21 – 40	Less Critical
0 - 20	Very Less Critical

Questionnaire data processing techniques start with counting the frequency of respondents choosing SS (Very Agree), S (Agree), KS (Less Agree), and TS (Disagree) on each statement. The percentage of each response either positive or negative was calculated below:

$$\% \text{ positive response} = \frac{number\ of\ student\ with\ positive\ response}{total\ number\ of\ student\ responding} \times 100\%$$

$$\% \text{ negative response} = \frac{number\ of\ students\ with\ negative\ response}{total\ number\ of\ students\ responding} \times 100\%$$

The sampling technique was a saturated sample. The procedures were started with a preliminary study through observation and interview. The steps of this study can be seen in Figure 2.

RESULTS AND DISCUSSION

Results

The observation results of teacher performance and student activities are shown in Table 3. Based on Table 3, the teacher's performance in managing learning from the first meeting to the fourth obtained an average score of 94.64% in very good criteria. While student's activities had an average score of 91,96% also in very good criteria. For pretest and posttest data, the results of student's thinking skills in each aspect of the experiment and control class are summarized in Table 4.

Table 3. Results of Teacher and Student Activities

	Meeting	Percentage of activities		Meeting	Percentage of activities
Teacher's activities	1	92.85%	**Student's activities**	1	81.48%
	2	92.85%		2	85.18%
	3	96.42%		3	88.88%
	4	96.42%		4	96.29%
	Mean	94.64%		**Mean**	91.96%
	Category	Very Good		**Category**	Very Good

Table 4. Analysis of Students' Critical Thinking Skills Aspects

Aspects of Critical Thinking	Experiment Class		Control Class	
	Score	**Criteria**	**Score**	**Criteria**
Basic Clarification	69	Critical	51	Quite
Bases for a Decision	78,5	Critical	66	Critical
Inference	55	Quite	52	Quite
Advanced Clarification	80,5	Critical	74,5	Critical
Employ Rhetorical Strategies	76	Critical	75	Critical
Mean	**71,8**	**Critical**	**63,7**	**Critical**

Data analysis results of the student's pre-test and post-test critical thinking skills in each class are provided in Table 5. According to Table 5, the results of the descriptive analysis for the experimental and control classes showed a minimum score of 26 and a maximum of 74. In the pretest analysis results of the experimental class, the minimum score is 37 and the maximum is 74. The post-test of the control class has a maximum score of 43 and a maximum of 83. While the post-test results of the experimental class have a minimum score of 57 and a maximum of 86. Normality tests are performed to see if the data is distributed normally or not. The result of the normality test is displayed in Table 6.

Table 5. Analysis of Students' Pretest and Postest Results

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test Experiment	20	37	74	55.40	10.47
Post-Test Experiment	20	57	86	73.90	7.65
Pre-Test control	20	26	74	51.55	12.21
Post-Test control	20	43	83	65.00	11.42

Table 6. Normality Test Results

	Class	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig
Critical thinking Test	Pre-Test of Experiment	.13	20	.173
	Post-Test of Experiment	.155	20	.200
	Pre-Test of control	.12	20	.200
	Post-Test of control	.131	20	.200

The normality test in Table 6 shows sig. pretest of experiment class 0,173 > 0,05 and sig. posttest experiment class 0,200 > 0,05. The conclusion is that the pretest and posttest on the experiment and control class were normally distributed. Since the data is normally distributed, then the homogeneity test using the statistical Levene test assisted by SPSS 25 to determine whether the data obtained is homogeneous or not. For a clearer view of the homogeneity test results, please refer to Table 7.

Table 7. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
1.872	3	76	.142

Based on the Table 7, the value of sig. 0.142 > 0.05. This suggests that the variance of experimental and control class data is homogeneous or equal. Since the data was normal and homogenous, then the hypotheses were tested using the t-test. The independent t-test is used to find out if there is any difference after giving treatment to the experiment and the control class. The results of the independent t-test more clearly are shown in Table 8.

Table 8. Independent t-Test Results

	T	df	Sig. (2-tailed)
Pre-Test	-11.250	38	.000
Post-Test	-14.044	38	.000

Based on the independent t-test in Table 8, the sig. (2-tailed) value is 0,000 < 0,05, so H_0 is rejected. Therefore, there is a significant difference in students' ability to think critically between the experimental and control classes. The questionnaire analysis result includes the students' responses to media in the aspects of attractiveness, efficiency, and practicality. The percentage of students' responses in each aspect is shown in Table 9.

Table 9. Results of Students' Response to Media

Aspects	NA	LA	A	VA
Attractiveness	0%	5%	70%	25%
Efficiency	0%	10%	70%	26%
Practicality	0%	10%	40%	50%

According to Table 9, the results of student responses to the media used in this study obtained good responses from students. On average, the highest percentage of each aspect was in the 'agree' category.

Discussion

Based on an analysis of the observation of teachers in the experimental class, which can be seen in Table 3, the percentage of results in one and two meetings is equal to 92.85%, and in the third and fourth meetings, the percentage of results is 96.42% with very good criteria. The results are consistent with the findings of Suswati (2021), where studying with the PBL model found that the activities of teachers and students increased. At the first meeting, the teacher's activity percentage produced 89.17%, then at the second meeting, teacher activities were 95%, then in the third meeting, it was known to increase more with a result of 96.67%.

The results of the observations for 20 students of the experimental class (Table 4) at the first meeting obtained a percentage of 81.48%, then at the second meeting obtained a percentual result of 85.18%, then in the third meeting achieved the percentages of 88.88%, and then in the last meeting, there was a return increase with a percentage result of 96.29%. The result of the Marpaung study (2021)are consistent with the findings of this investigation, where in learning with the learning model PBL found that the student's activity increased. During the learning process, the student is no longer an object of learning, but an individual who maximizes his potential. Problems that are focused on learning and solved through group work enhance the ability and activity of students to solve problems with scientific methods (Purnadewi & Widana, 2023; Suswati, 2021; Ulfa & Kanigara, 2024). The implementation of the PBL model is appropriate due to its numerous benefits, which include: (1) increasing student engagement in both physical and mental domains; (2) fostering learning through experience rather than memorization; (3) using the classroom as a location for problem solving in the real world; and (4)

allowing students to construct the subject matter under the guidance of the teacher (Ariyani & Kristin, 2021; Dulyapit et al., 2023; Fuaidah et al., 2020).

Based on the description of the results of the post-test in Table 6, the average post-test student score in the experimental class was 73.90, whereas in the control class, it had an average score of 65.00. This indicates that in the experiment class, there was a higher average of the post-test critical thinking skills that that of the control class. These results are supported by Habibah et al. (2022), Kusumawardani et al. (2022), and Awami et al. (2022) which demonstrated that students who studied using the PBL model had superior critical thinking skills than those who studied using traditional techniques. The conventional learning model in this study uses the discovery learning model as it is commonly used by teachers in their studies. On both PBL and conventional learning models, the average student is still 'less' on the inference aspect. The inference aspect is the ability of the student to make a conclusion accurately and to give or choose reasons to support the conclusion that has been made (Setiana & Purwoko, 2020). The ability of students in making conclusions is influenced by the motivation and self-confidence of students. The ability of students in making conclusions is also influenced by the level of understanding that students have (Hasibuan et al., 2022; Jannah & Budiman, 2022; Rahmayani & Fadly, 2022). However, from both classes, the experiment and the control class obtained the critical thinking category with the critical category. Even in the same category, the averages of the two classes have differed. The experiment class received 71.8, whereas the control group's average score was 63.7. This may have happened because the basics of the two models are almost the same, which exposes the problem to learn.

Based on Table 6 and Table 7, both experimental and control classes were found to be normal and homogeneous. Based on the T-test or independent t-test in Table 8, the sig. (2-tailed) value is $0,000 < 0.05$, so H_0 is rejected. Hence, it can be stated that students' critical thinking before treatment differs significantly between the experiment and control classes. From this study, a local wisdom-oriented PBL assisted by interactive e-magazines is better at enhancing students' critical thinking skills. This study by (Budiarti & Airlanda, 2019; Ridho et al., 2021) strengthens this finding by stating that the implementation of a PBL model based on local wisdom has been shown to improve and train critical thinking skills. The local wisdom-based learning relates to the system of life values, which consists of religion, customs, and culture (Isrotun, 2022; Nuralita, 2020; Syahidi et al., 2020). At its core, learning that utilizes local knowledge content can help students by applying it to real learning (Lestari et al., 2022; Syukur & Sutrisno, 2023). As with the learning concept of Natural Sciences, is largely derived from experiences and constructive concepts that originate from everyday life (Sartika et al., 2022; Wisudawati & Sulistyowati, 2022). Learning done using a local wisdom-oriented PBL model will stimulate students to be more creative in thinking and solving problems, independent, active, and developing cooperation and responsibility (Budiarti & Airlanda, 2019; Dulyapit et al., 2023; Purnadewi & Widana, 2023). Therefore, it can be claimed that PBLs based on local wisdom assist students in learning and enhance their capacity for critical thought.

In order to facilitate student understanding of the content being taught, the teacher employs learning media in their instruction. Teachers combine a local wisdom-oriented

PBL learning model with interactive magazines. This interactive magazine contains features as well as pictures, video tutorials, and links to specific websites. Interactive magazines are also presented interestingly so students will not be easily bored. Other features like video buttons and animations like clicking on the page also make it easy for students to choose the page they want and improve the user experience. The learning media with visual audio support such as the interactive magazine used is designed to facilitate students to develop research and problem-solving skills and improve students' ability to think critically. (Harahap & Siregar, 2020; Prabowo, 2021; Pratiwi & Mawardi, 2022).

Based on the analysis of student responses in Table 10, the attractiveness aspects of interactive journals got the highest percentage of 70% in the 'agree' category. This indicates that the interactive magazine used in learning is considered attractive to students. Then on the effectiveness aspect of the interactional magazine got the top percentages of 70% on 'agree' categories. This means that interactive magazines used in teaching are considered effective for students. Further on the practical aspect of an interactive journal got the greatest percentage of 50% in the very agree category, and 40% in agree categories. The findings are in line with research by Maria et al. (2022), Haka et al. (2021), and Rahardhian et al. (2023) that teaching media that utilize technology gets a good response from students. An intriguingly packed Android-based learning medium that enhances the learning process, making it more effective, exciting, and practical..

CONCLUSION

Fundamental Finding: Based on an analysis of observations of teachers and students in learning with the PBL model, it was found that teacher and student activities were very good, the test after treatment showed an improved category from less to critical category, then the responses stated that the media was attractive, effective and practical. **Implication:** The implementation of a local wisdom-oriented PBL model assisted by interactive magazines improves students' critical thinking skills. **Limitation:** In this study, critical thinking was measured in general on the topic of additive and addictive substances. **Further Research:** Based on the results, further research can be conducted with the aid of the various interactive media and orientation based on the characteristics of material

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