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THE ROLE OF PROBLEM-BASED LEARNING WITH ROOT CAUSE ANALYSIS ON STUDENT DISASTER LITERACY

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Abstract

Indonesians must have high literacy to know about the disasters around them. There needs to be a learning model to improve disaster literacy. One of the alternatives is the Problem-based learning model with Root Cause Analysis. This research is a quantitative type of pseudo experiment with a pretest-posttest control group design where the pretest-posttest results of the experimental class and control class are compared to determine the effectiveness of the treatment in the experimental class. There are no particular specifications regarding the characteristics of the class used in the study. Data analysis used a sample t-test supported by prerequisite tests such as homogeneity and normality tests. The PBLRCA model has a significant effect on students' disaster literacy skills. The results showed increased literacy skills at a t value of 5,787. Steps such as independent review, investigating the root of the problem, and implementing action plans that can make PBLRCA students read, explore and analyze situations in depth more than Lecturing Method. These activities make students' disaster literacy improve.

Keywords: Problem-Based Learning, Root Cause Analysis, Disaster Literacy.

INTRODUCTION

Indonesia is an area prone to disasters. There were 10,052 recorded events in 2020-2021. The disaster caused 1,104 fatalities, and 14,427,399 people suffered losses (Badan Nasional Penanggulangan Bencana (BNPB), 2020, 2022). Indonesia's position means it will continue to have a high disaster risk. Literacy is an important point to face and reduce the risk of such disasters (Chandra, 2021).

Literacy makes people more aware of disaster events around them. Adi Maulana stated that low literacy causes people not to know disaster mitigation and how to prevent and prepare themselves to be prepared for disasters (Vinta, 2023). Dito Anurogo also stated that disaster

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literacy aims to increase public awareness and strengthen the capacity of individuals and institutions to deal with disasters (Anurogo, 2023).

Indonesia's literacy level is low (Suparya et al., 2022). Some other evidence can be seen from the 2019 Program for International Student Assessment (PISA) rankings from the Organization for Economic Co-operation and Development (OECD). Indonesia is ranked 62 out of 70 countries or among the ten least literate countries globally (Ilham, 2022). That statement is reinforced by research conducted on four countries studied in Japan in 2009: Japan, Sri Lanka, America, and Indonesia. Indonesia has a very poor literacy level (Chandra, 2021).

One solution to overcome the problem of low literacy is education. There is a need for natural disaster preparedness education, including learning models, to improve disaster education in schools (Saregar et al., 2022). The need for disaster education is also supported by the Ministry of Education and Culture, which actively issuing the Disaster Safe Education Unit program (Permendikbud RI No. 33 Tahun 2019 Tentang Program Satuan Pendidikan Aman Bencana, 2019). The Aceh government also formulated the draft Aceh Disaster Education Qanun, which consists of 14 chapters and 40 articles (Tim Penyusun Naskah Akademik Universitas Syiah Kuala, 2019). A tangible form of these solutions and regulations is the learning model.

The Problem-Based Learning (PBL) model is an alternative to solve this problem. The problem-based model can encourage students to think critically and objectively and analyze a problem that occurs in the field (Bashith & Amin, 2017; Sumarmi, 2012; Ware & Rohaeti, 2018). Problem-Based Learning focuses on authentic problem-solving so that students can develop higher skills and compile their knowledge, which impacts increasing literacy (Hosnan, 2014).

Problem-Based Learning is expected to improve its ability when combined with Root Cause Analysis (RCA). RCA can provide various alternative solutions to overcome the problems that occur. The American Society for Quality defines "Root cause analysis is an essential component of sustainable growth and a more comprehensive approach to problem solving. As a result, one of the fundamental pillars of an organization's continuous improvement efforts is root cause analysis. Root cause analysis must be part of a larger effort to solve problems in order to improve quality, as it will not result in improvement" (Cerniglia-Lowensen, 2015; Ma et al., 2021). RCA makes planning and exploration of problems for their causes. Root cause analysis (RCA) investigates side effects (Pham et al., 2010).

Research on the application of PBL combined with RCA has yet to be widely conducted in education, especially regarding disaster literacy. The research is evidenced by the limited number of journals that can be used as references regarding the effect of RCA in learning, especially Problem Based Learning with Root Cause Analysis (PBLRCA). Suharini has conducted research on PBL on literacy entitled "The Strategy of Disaster Mitigation Literacy through Problem-Based Learning (PBL) in the School Prone to Tidal Floods," which aims to present the effect of disaster mitigation literacy strategies through PBL learning in schools prone to tidal floods. However, this research does not involve RCA (Suharini et al., 2020). Meanwhile, RCA research has been conducted by Serdar Kum and Bekir Sahin entitled "A root

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cause analysis for Arctic Marine accidents from 1993 to 2011". This paper focuses more on investigating marine accidents in the north from 1993 to 2011 to see the causes (Kum & Sahin, 2015).

LITERATURE REVIEW

Disaster Literacy

In line with this, Çallşkan & Üner (2021), The capacity of individuals to make decisions and follow instructions following information that has been accessed, received, and understood about disaster mitigation includes preparation, response, and recovery to maintain life after a disaster.

Measuring the capacity of a person and community to understand, read and use the information to make informed decisions and be able to follow instructions in the context of pre-, during, and post-disaster is called disaster literacy (Brown et al., 2014a; Muktaf, 2017). Meanwhile, Kanbara states that disaster risk reduction literacy will reduce the risks that arise through awareness, knowledge, and techniques so that they can make quick decisions when facing disasters (Kanbara et al., 2016). In line with this, Çallşkan & Üner (2021), The capacity of individuals to make decisions and follow instructions following information that has been accessed, received, and understood about disaster mitigation includes preparation, response, and recovery to maintain life after a disaster.

Disaster literacy indicators

The level of disaster literacy can be seen from three dimensions: knowledge, attitudes, and skills. The three dimensions include disaster knowledge, preparedness knowledge, disaster response knowledge in the knowledge dimension, prevention values, responsibility, and awareness in the attitude dimension. Preparedness actions and response behaviors are in the skills dimension (Sung-Chin Chung & Cherng-Jyh Yen, 2016).

Chen & Lee (2012) define disaster literacy as knowledge, attitudes, and skills. Chan et al., (2012) and Olowoporoku (2017) consider disaster literacy to be the ability to identify, understand, interpret, and communicate information related to disaster risk. Disaster literacy is the capacity to read, understand, and use information to make informed decisions during a disaster (Brown et al., 2014; Zhang et al., 2021). while Kanbara et al., (2016) s stated that disaster literacy consists of awareness of knowledge and techniques that will help reduce disaster risk. Then the researcher decided to use the definition of disaster literacy according to Chen & Lee with modifications in indicators according to the definition according to Sung-Chin Chung &; Cherng-Jyh Yen, which is described as shown below

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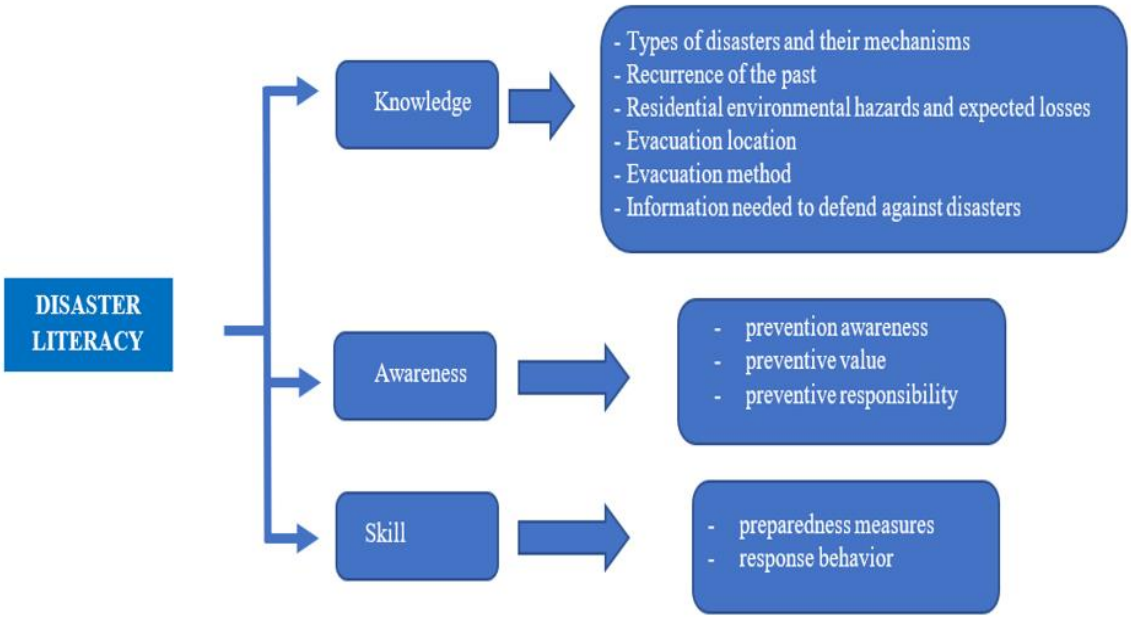

Figure 1: Disaster literacy concept

Problem-based learning

Problem-based learning is a suitable model to be applied today in transferring knowledge. Hamdayama (2016) and Hosnan (2014) explain that a model that departs from real-world problems Problem-Based Learning is learning that focuses on authentic problems surrounding students so that they can compile knowledge and develop skills. Problem-based learning is also an innovative model that can improve critical thinking skills so that students can find solutions when faced with problems in the real world (Fitra & Yenni, 2017).

However, problem-based learning has several obstacles in its implementation, including requiring more time to (Cónsul-Giribet & Medina-Moya, 2014; Ghufron & Ermawati, 2018). Students become afraid to speak openly, lose the desire to learn, are lazy to ask questions, and participate less in class discussions. The habit of putting the interests of the group over the individual. Barriers in literature limitations, number of assignments, and time (Asni & Hamidy, 2010). Requires adequate facilities, equipment, and materials. Not suitable for students who give up easily (Niswara & Fita Asri Untari, 2019). High-group students sometimes have high selfishness, and sometimes low students do not care about themselves, so there is no effort to catch up with their friends. The discussion and question-and-answer process occurs only between high-ability and medium-ability students. "What often happens is that high-ability students who are supposed to help less selfish friends tend to like to solve problems alone. Likewise, low-ability students do not care about themselves (Tyas, 2017).

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Root Cause Analysis

The root cause analysis method can be one of the alternatives to strengthen PBL in overcoming the weaknesses of PBL. Root cause analysis is a way to find the underlying cause. The investigation should be able to identify specific underlying causes. The more specific causes can be investigated, the better the disaster prevention recommendations. Specific causes can make effective changes. Knowing the exact cause of failure before action is taken can prevent the recurrence of the failure or error (Rooney et al., 2004). Root cause analysis was originally a problem-solving technique used in quality management and is a powerful tool to pinpoint obstacles for improvement (Andersen & Fagerhaug, 2006; Wilson et al., 1993). It is usually used in a reactive mode to determine the causes of problems that have already occurred. Root cause analysis using 5 Whys, Pareto, and fishbone diagrams can be performed. These techniques help users to identify the root causes that need to be addressed to solve 80% of the problems. Once the root causes are identified, tools such as the Ishikawa diagram or fishbone diagram can be used to illustrate the root causes of the problem. Then efforts can be made to remove the main bottlenecks to develop a more sustainable process (Jayswal et al., 2011). RCA can quickly identify the side effects of problems so that management or groups can design individual evaluations and develop evidence-based evaluation tools to measure improvements in work effectiveness (Taitz et al., 2010).

Problem-Based Learning with Root Cause Analysis

This research uses the PBL learning model combined with RCA. PBL is a coaching method that "simultaneously develops complexity-fixing techniques, disciplinary understanding, and skills by placing students in active positions as problem solvers faced with dependent problems that reflect actual-global situations" (Barrett, 2006).

PBL is used based on its success in solving problems for medical students. This model makes students understand how to think critically, solve problems, and gain essential knowledge and concepts from lectures or subject matter. At the same time, RCA, according to the American Society for Quality (2020) defines "A more thorough approach to problem-solving and continual improvement both require root cause analysis. Therefore, one of the key tenets of an organization's continuous improvement initiatives is root cause analysis. It's critical to keep in mind that root cause analysis by itself won't lead to quality improvement; instead, it needs to be included in a larger effort to address issues". RCA does planning and extracting from problems to their causes. Pham et al., (2010) state that Root cause analysis (RCA) is a process used to investigate adverse effects.

Combining PBL with RCA will strengthen the advantage of PBL in deeper data mining. PBLRCA is necessary for investigating and discovering pressing problems, understanding the main causes of the situation, and treating the problem correctly and appropriately through the deep-digging steps of RCA to prevent the same problem from arising again. Such data mining in the RCA stage is also likely to develop the investigator's knowledge. Meanwhile, the work effectiveness measured in the RCA can also improve one of the literacy indicators: skills. As a

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result, it can include identification and procedures, process management, activities, activities, conditions, or behaviors (Figgins, 2012).

Figure 2: Syntac Problem Based Learning with Root Cause Analysis

METHODOLOGY

Research Design

Quantitative is the approach used in this study with pseudo-experimental research. The pseudo-experiment used a pretest-posttest control group design where the pretest-posttest results of the

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experimental class and control class were compared to determine the effectiveness of the treatment in the experimental class. The implementation involves two classes: the experimental class uses PBL learning combined with RCA. The experimental class will perform the PBLRCA steps using the syntax (Figure 1) below. Students are required to provide and implement alternative solutions in dealing with problems. Meanwhile, the control class uses the lecture learning method.

There are two types of instruments used in this study. The first is a test instrument used to measure students' knowledge. In comparison, measure attitudes and skills using descriptive questionnaire instruments based on disaster literacy indicators. In this research, the lecturer acts as a facilitator and provides direction and observation to students about the effectiveness of PBLRCA learning.

Table 1. Research Design

Class	Preliminary Test	Treatment	Final exam
Experimental	O1	X	O2
Control	O3	-	O4

O1 : Pretest for Experimental Classes

O2 : Posttest for Experimental Class

X : PBLRCA Learning

O3 : Pretest for Control Class

O4 : Posttest for Control Class

\- : Lecturing Method

Before obtaining research results, instruments must be valid and reliable to measure disaster literacy, so validity and reliability tests must first be carried out. The implementation of PBLRCA learning is integrated into the student activity guide sheet, which is arranged based on the learning syntax. The experimental and control classes conducted a pretest through an assessment instrument at the beginning of learning. After the PBLRCA learning treatment was applied to the experimental class, a disaster literacy posttest was conducted for the experimental and control classes using the same questions but randomized. The pretest and posttest scores were then analyzed for the normality test and homogeneity test as prerequisite tests so that it is known that the data is represented to be used in hypothesis testing. After hypothesis testing, if there is a significant difference in the data of the experimental and control classes, then the PBLRCA learning model is considered to affect disaster literacy.

Sample and Data Collection

There were no special specifications regarding the characteristics of the experimental and control classes. Experimental and control classes are selected based on the need to see disaster literacy. Therefore, the subject of this research is students of the Geography Education Study Program, Faculty of Teacher Training and Education, Universitas Samudra, in the 2020- 2021 academic year who are studying disaster geography courses. The choice of students as research

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subjects is because the level of education is a major factor in literacy. The selection of students is also because learning on campus has a relatively long learning time than school, so the weakness of PBL in time problems can be overcome. The control class had 29 students, and the experimental class had 31 students. Students' ability in both classes can be considered equal, as evidenced by the average student learning outcomes that are not much different from the control class, which has an average score of 67.86. In comparison, the experimental class has an average value of 66.15.

This study used an instrument adapted from Zhang and Cheng. The tool is in the form of 50 question items representing indicators to measure disaster literacy. The tool contains three indicators of disaster literacy: Awareness (divided into beliefs and discrimination), knowledge, and techniques representing respondents' behaviors and actions (Kanbara et al., 2016; Sung-Chin et al., 2016). Before using the instrument, it is confirmed to be valid first through a validity test. The validity test results show that the tools used are correct. Furthermore, Cronbach's Alpha was used to evaluate the reliability of the research tool. The reliability test results showed the dependability of the tool for numbers (Alpha = 0.628).

Table 2: Indicators of disaster literacy test questions

No	Disaster Literacy Indicators	Sub Indicators
1	**Knowledge**	Disaster knowledge
		Occupational hazards
		Information for self-defense
		Evaluation method and location
		Lessons from the past
2	**Attitude**	Prevention Awareness
		Prevention Value
		Preventive Responsibility
3	**Skills**	Preparedness Measures
		Response Behavior

Analyzing of Data

The use of independent sample t-test statistics is considered appropriate to test the data in this study, supported by prerequisite tests in the form of homogeneity and normality tests. The level test is used to see the homogeneity of items, while for normality, using Shapiro-Wilk with a significance value of both tests of 5% or 0.05. Data analysis was conducted using SPSS software version 21 for Windows. Hypothesis testing in this study is as follows.

H0: The level of disaster literacy is the same before and after the implementation of PBLRCA.

H1: There is a difference in the level of disaster literacy before and after the implementation of PBLRCA.

Decision-making criteria: If the significance value is <0.05, then H1 is accepted. If the significance value > 0.05, then H1 is rejected.

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FINDINGS/RESULTS

Disaster Literacy Data

The table below shows data from knowledge indicators obtained through tests conducted after treatment using PBL-RCA learning. The results of these values are compared with the control class that was not given PBL-RCA learning.

Table 3: Distribution of Posttest Score of Disaster Literacy Indicator: Knowledge

Value Interval	Category	Disaster Literacy Indicators: Knowledge			
		Experiment		Control	
		f	%	f	%
80-100	Very good	14	45	4	14
60-79	Good	17	55	25	86
40-59	Simply	0	0	0	0
20-39	Less Good	0	0	0	0
0-19	Very Poor	0	0	0	0

The table shows that after the treatment the level of knowledge of students on disasters in the experimental class looks better than the control class.

Next is the data on the level of disaster literacy seen from the indicators of skills and attitudes. In this indicator, the value is obtained from a questionnaire filled out by students. Skills are high after the PBL-RCA learning treatment. While the attitude value can be said to be equivalent to the control class.

Table 4: Distribution of Posttest Score of Disaster Literacy Indicator: Skills

Value Interval	Category	Disaster Literacy Indicators: Skill			
		Experiment		Control	
		f	%	f	%
80-100	Very good	24	77	14	48
60-79	Good	7	23	11	38
40-59	Simply	0	0	4	14
20-39	Less Good	0	0	0	0
0-19	Very Poor	0	0	0	0

Table 5: Disaster Literacy Indicator Posttest Score Distribution: Attitude

Value Interval	Category	Disaster Literacy Indicators: Attitude			
		Experiment		Control	
		f	%	f	%
80-100	Very good	15	48	8	28
60-79	Good	16	52	17	59
40-59	Simply	0	0	4	14
20-39	Less Good	0	0	0	0
0-19	Very Poor	0	0	0	0

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Before analyzing the impact of PBLRCA learning on students' disaster literacy skills, normality, and homogeneity tests were conducted. Table 2 shows the results of acquiring literacy normality test data using the Shapiro-Wilk test.

Table 6: Normality Test Results

Class	Shapiro-Wilk		
	Statistics	Df	Sig.
Experiment	.976	31	.701
Control	.932	29	.064

The test results show that the significance obtained from the normality test in the experimental class is 0.701, and the control is greater than 0.064. Based on the significant value, which is greater than the table value of 0.05, it can be interpreted that the acquisition of literacy skill score data in control and experimental classes are normally distributed.

Table 7: Homogeneity Test Results

Levene Statistics	df1	df2	Sig
.640	1	58	.427

The data on disaster knowledge scores of the experimental and control classes varied uniformly, as shown in Table 5, where sig. 0.427 > = 0.05 with a Laven statistic of 0.60. According to the results of the two prerequisite tests, the data had normal distribution and homogeneous variance.

Data analysis

Students must have disaster literacy as agents of change to reduce disaster risk in their environment. The results found that the PBLRCA model has a higher value than the Lecturing Model. The study results can be seen from the increase in student scores. This increase occurred in each indicator of disaster literacy which can be seen from the N-Gain (table 6). Based on the table below, it is known that there is a difference in scores between the N-Gain of the control class and the experimental class of 9.6 on the awareness indicator, nine on the knowledge indicator, and 8.8 on the skill indicator. In the three disaster literacy indicators, the experimental class's N-Gain value is always superior to the control class.

Table 8: Disaster literacy values in the learning model

Disaster Literacy Indicator	Model	Pretest	Posttest	N-Gains
Awareness	PBLRCA	57.3	81.8	24.6
	Lecturing Model	58.6	73.6	15.0
Knowledge	PBLRCA	56.4	81.1	24.7
	Lecturing Model	57.2	72.9	15.7
Technique	PBLRCA	56.5	79.4	22.9
	Lecturing Model	57.1	71.2	14.1

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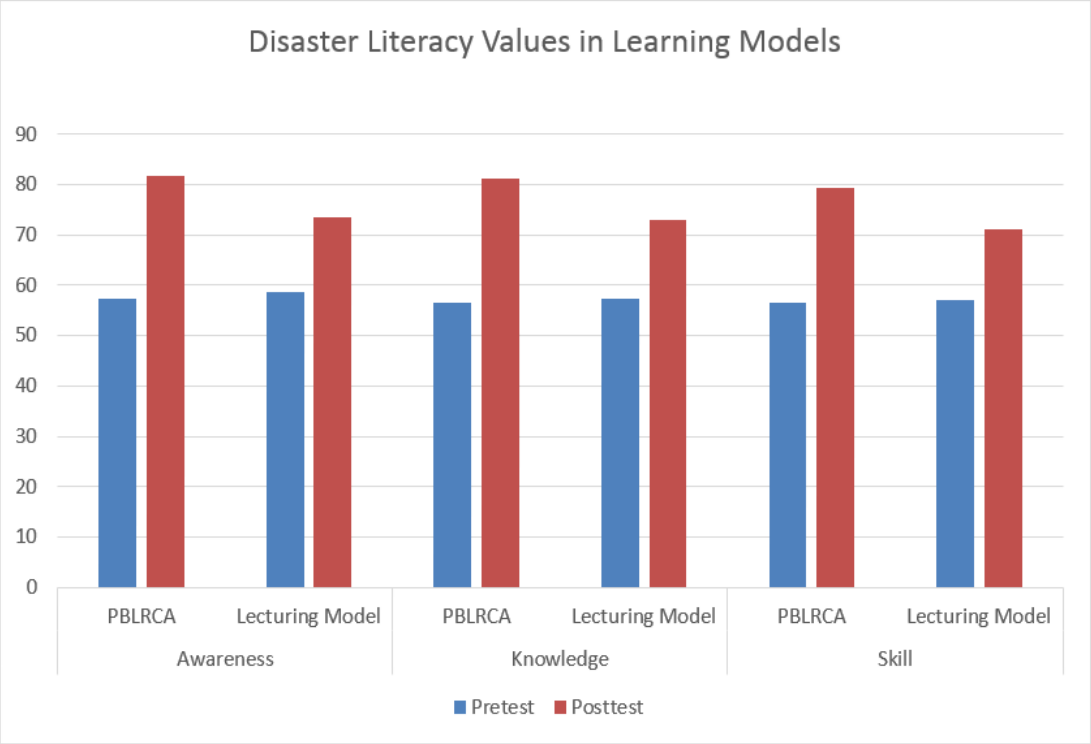

Figure 3: Disaster Literacy Values in the Learning Model

Hypothesis Test

The impact of the PBLRCA model on disaster literacy was then assessed using independent sample t-test data analysis based on disaster literacy scores. Table 9 contains a synopsis of findings from independent sample t-test examinations.

Table 9: Independent sample T-test results

	t	df	Sig. (2-tailed)	Mean Differences
NGain_percent	5,787	58	.000	21.75093

Based on the results of the data analysis above, it is known that the significance value of PBLRCA learning is 0.00. This value meets the criteria for accepting H1 because the value is less than 0.05. Therefore, it is stated that there is a significant difference in the level of disaster literacy before and after the application of PBLRCA learning.

DISCUSSION

Based on the results of the data analysis above, it is known that there is an increase in disaster literacy after PBLRCA is used in learning. As seen in the table data, it is known that in comparing the average pretest and posttest, there is a difference in the average value of N-Gain of 9.1 points (Table 8).

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The improvement of disaster literacy is possible due to the steps/syntax in PBL-RCA learning. There is a slight difference between PBL syntax and PBL-RCA. PBL-RCA is a modification of RCA, so the steps are almost similar but with some additions. PBL-RCA has two more steps than PBL, which has six rare steps. The two steps between PBL and PBL-RCA include examining the problem deeply using RCA and Implementing an action plan. The other steps are similar to regular PBL steps that are varied with RCA. One of them is step 6 in the form of a varied presentation by presenting an action plan to solve the problem.

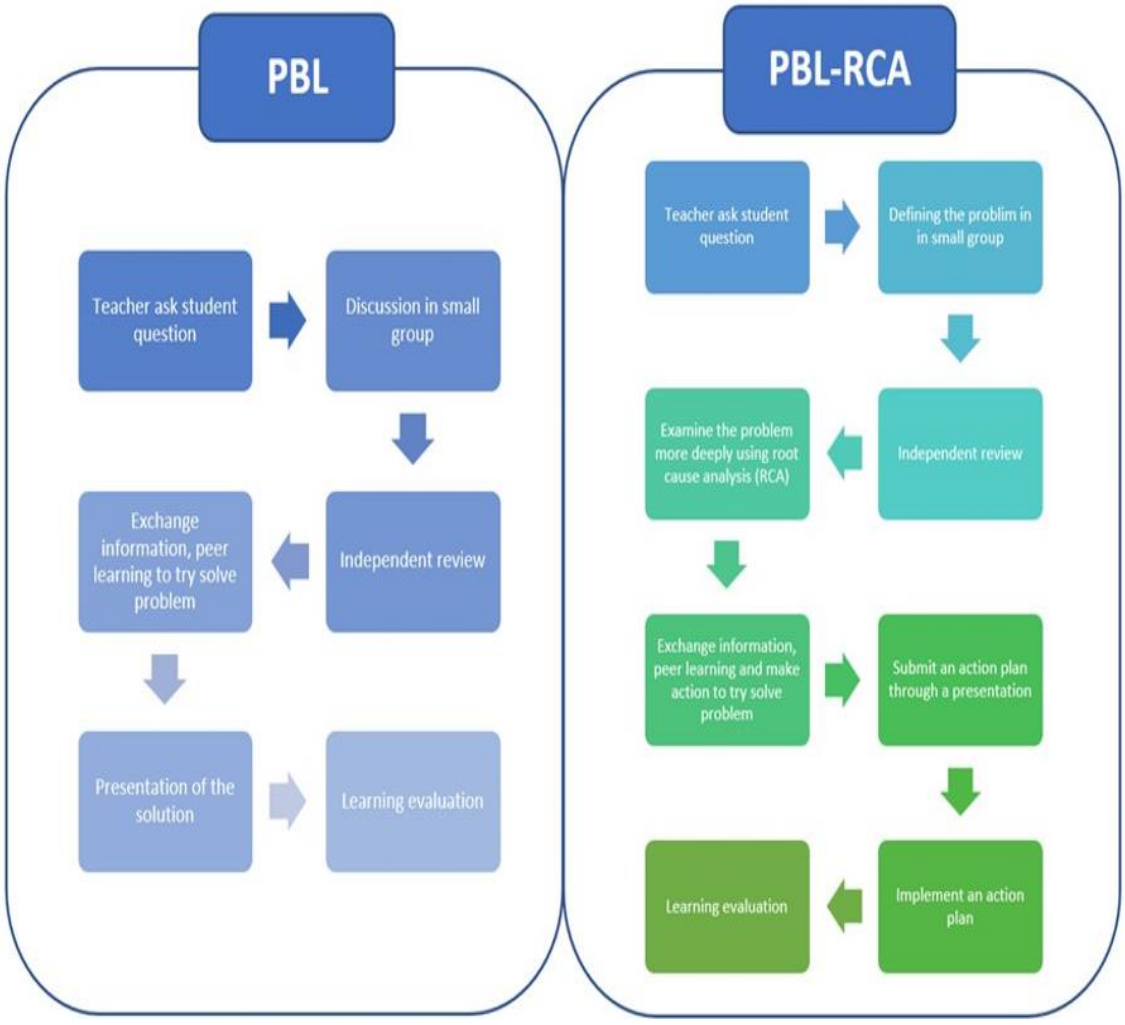

Figure 4: Differences between PBL and PBL-RCA

The improvement of disaster literacy is possible due to the steps/syntax of PBL-RCA learning. The first step is an important point in learning. The first step of PBL-RCA is to throw problems at students. This step makes students able to study the problem more focused. Students can focus on finding literature related to the problem whose theme has been determined. That Activity leads all students to work on tasks per the learning objectives set by the lecturer.

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The problem-solving process will be carried out in the third PBL-RCA step: conducting an independent review. In the independent review process, students review reading materials with themes given by the lecturer. After conducting the study, students are asked to conclude the study results. This step makes students study many things related to the existing problems through various kinds of literature. Independent study will be richer if it is strengthened by investigating the root of the problem (the fourth step in PBLRCA). Analyzing the root of the problem can strengthen the independent study of PBL to be more in-depth by examining the issue through various investigation forms, including a literature review. In this step, students collect literature from various news, newspapers, books, and even articles in national and international journals.

Reading the literature in depth, carried out in this step, indirectly increases students' understanding of PBL (Prabowo et al., 2023). (Prabowo et al., 2023). The habit of reading also makes students acquire high-level skills to improve themselves professionally and personally (Dogan et al., 2020). Apart from that, students' habits of reading and exploring coupled with reflection can also improve literacy skills (Nurtanto et al., 2020). In line with this Afrian & Islami (2019) stated that disaster literacy skills could be overcome by providing various forms of reading, reading, and learning practices that also impact improving literacy skills.

In the fourth step of PBLRCA, investigating a problem, students are asked to separate the causal factors of the selected disaster event and the root cause of the disaster. Exploring is important because by elaborating on these two things, students can more easily find the basis of the problem. In line with the opinion of Wang et al. (2017), who stated that with in-depth study, students could find various causes and solutions to one observed disaster problem. PBL improves problem-solving skills that enable students to provide solutions according to information, and knowledge increases along with the investigation process in learning (Sari et al., 2021).

Students conduct investigations using various inquiry methods, including five why questions and brainstorming (students can choose one of the brainstorming models, such as mind mapping, swot analysis). This stage was influential on students' level of knowledge and attitude. Root cause investigation also forces students to gather relevant information to build knowledge (Wajdi et al., 2022). Root cause investigation also forces students to gather relevant information to build knowledge, which is also part of literacy skills (Kanbara et al., 2016; Wajdi et al., 2022). Information-gathering activities teach them to focus on relevant and valid details (Dewi et al., 2022). They investigate problems related to extracting and collecting data to determine the best solution to the problem (Suwono et al., 2023).

D During the implementation of PBL-RCA in the experimental class, students were forced to study the problem by searching the literature for three meetings. This activity is strengthened by exploring the theme to the root of the problem through literacy studies, direct observation, and interviews in the field. Students conduct this field observation activity for two meetings to find other factors that may differ between the theory and the original conditions in the field. Field observations help students build solution formulations based on hypotheses that have been found. In addition, root cause analysis is carried out in the form of direct investigation to

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find and identify the root cause so that the reason for the occurrence of a disaster event can be found (Al-Mamory & Zhang, 2009). The analysis process to find formulations and hypotheses based on these problems will impact the development of literacy (Amaringga et al., 2021). Evidence of literacy development can be seen in the N-Gain of one of the indicators, namely knowledge, with a difference of 9.0 points when compared between the use of the PBLRCA and Lecturing Method.

The next step of PBLRCA that supports the improvement of disaster literacy is the process of building an action plan. Building an action plan in PBLRCA requires the ability to dissect and explore problems. This is in line with the results of research Amin et al., (2020) which states that the PBL model can encourage students to actively analyze facts, events and problems through data collection and discussion to build their background knowledge from the beginning to the end of the learning process. Students need to learn deeply about the problem, especially about events that occurred in the past. In-depth root cause analysis is carried out to avoid failure to overcome past problems that lead to improved literacy skills (Fahri Mundzir & Sujana, 2017; Livingston et al., 2001; Zhang et al., 2021).

Implementing the action plan is also one of the steps that can improve students' disaster literacy skills in the PBLRCA learning model. Substantial experience gained directly in the field through observation activities is the basis for students to develop their thinking skills to solve real problems in the surrounding environment (Yuniar Priyandari et al., 2020). Implementation activities are believed to increase disaster literacy in technical indicators (Ussarn et al., 2022). Students are invited to be able to implement the results of their construction in real daily life or in the form of problem solving. The lack of direct student involvement in sustainable issues affects the lack of responsibility for the environment (Handoyo et al., 2021). So that the need for individual involvement has gone further in the implementation of making attitudes toward the problem grow (Kasi & Astina, 2017). If students are involved in disaster implementation, an attitude of caring for disasters will grow. If students are involved in disaster implementation, an attitude of caring for disasters will grow. Disaster literacy will develop if individuals understand broader information and broader situations, especially those related to environmental and social safety barriers (Muktaf, 2017). Disaster literacy ultimately refers to a person engaging with using his or her experience to solve real problems as a platform to understand the aspects and risks of disaster impact management (Brown et al., 2014b; Purwanto et al., 2023; Susanto et al., 2016).

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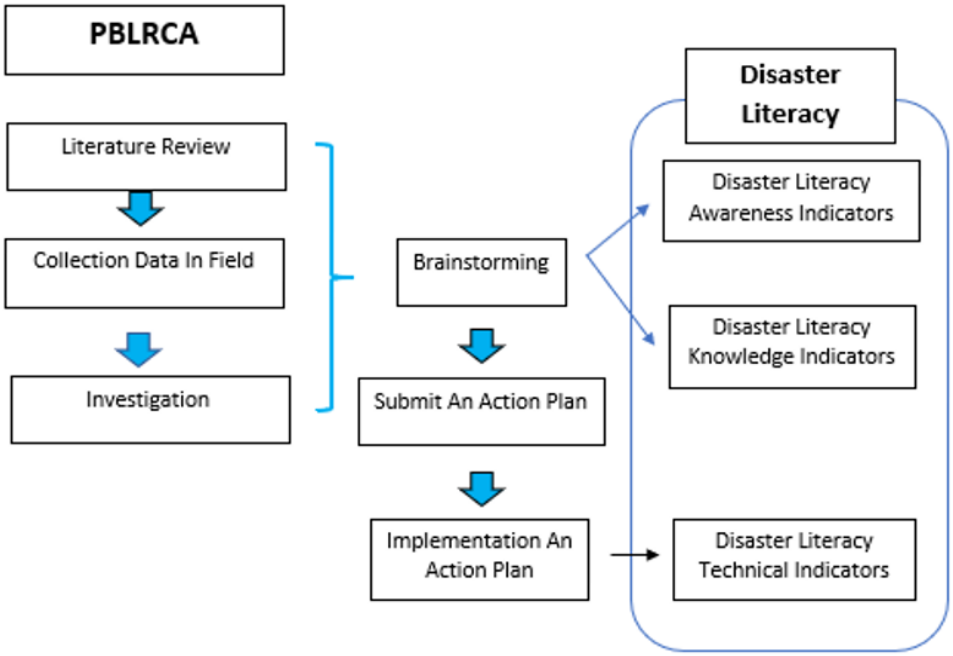

Figure 3: Step PBLRCA to increase Disaster Literation

CONCLUSION

Based on the study's results, it is concluded that the PBLRCA model significantly affects students' disaster literacy skills. The results showed increased literacy skills at a t value of 5,787. The average disaster literacy score in the experimental class was higher than in the control class. The N-Gain difference between the experimental and control classes was 9.1 points. Steps such as investigating the root of the problem and proposing and implementing an action plan made PBLRCA students read, explore and analyze the situation in depth more than PBL. These activities made students' disaster literacy improve.

Research using PBLRCA is limited to disaster mitigation materials, so it is recommended for further research to conduct PBLRCA on other materials. This suggestion is intended to strengthen the research results that the application of PBLRCA is needed to provide problem-solving solutions in the field.

Recommendations

The researchers hope to conduct a more in-depth analysis of the variables affecting student disaster literacy using research methods such as PTK and qualitative. In addition, it is expected that a comparative test with similar learning models is needed to see the effect of the PBLRCA model in improving disaster literacy. It is also expected that solutions to overcome disasters obtained from learning models can be applied in disaster risk reduction efforts. Furthermore, it is hoped that the PLRCA model can be applied in disaster theme learning, considering that Indonesia is a vulnerable area, so that people become aware of disasters.

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Limitations

The use of PBLRCA in this study was only carried out to see the development of disaster literacy levels. The material applied is also only on disaster geography. So problem-solving is only limited to matters related to the disaster. So there is a possibility of different results when implemented on other materials and content. There is pressure from lecturers in the assessment because it is a guideline for assessing the courses researchers teach. There may be inconsistencies when conducted at different times.

Authorship Contribution Statement

Ramdan Afrian: Concept, Design, Drafting, Data Analysis.

Sugeng Utaya: Final Approval, Data Acquisition, Data Interpretation

I Komang Astina: Conceptualization, Supervision

Syamsul Bachri: Critical Revision of Manuscript, Supervision, Final Approval

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