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RESEARCH ARTICLE
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Implementation of Collaborative Learning to Improve Knowledge about Rabies among Students at Elementary School in Dompu, West Nusa Tenggara Province, Indonesia

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ABSTRACT

Rabies is a zoonotic and deadly disease transmitted through dog bite to humans. Among school children, dog bite cases mainly occurred due to a lack of knowledge of rabies, which poses a significant challenge to its effective control. Therefore, the present study is carried out in the Dompu district, West Nusa Tenggara Province, Indonesia, with the aim to analyze the implementation of collaborative learning to increase the knowledge of elementary school students about rabies and its effectiveness as a learning delivery method. The design of this research used a quasi-experiment with pre-test and post-test. The intervention group used collaborative learning, while the control group followed the lecture method. The instrument was a structured questionnaire, validated by Pearson correlation and reliability tested with Alpha-Cronbach. Data was collected from interviewed elementary students in Dompu and Woja sub-district, Dompu District. The intervention group included 57 students, while the control group had 49. Pre-tests were conducted before the intervention, and post-tests were conducted three times: on the same day, one week, and one month after the intervention. The outcome data were analyzed using a chi-square test, independent sample t-test, and Hake's formula. The result showed that the source of rabies information is significantly associated with knowledge of rabies among students (α=0.014). Student's rabies knowledge score was significantly increased by both the collaborative learning and lecture methods ($P<0.05$). The n-gain score of collaborative learning was more than 0.7, categorized as effective, compared to the lecture method score of 0.3-0.7, categorized as moderately effective. It was concluded that the collaborative learning method effectively improved elementary school student's knowledge about rabies.

Keywords: Collaborative learning, Elementary students, Indonesia, Knowledge, Rabies

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INTRODUCTION

Rabies is a zoonosis with significant social and economic impacts, globally. According to the World Health Organization (2023), the estimated consequence of rabies on the global economy is US$8.6 billion per year. This amount represents human death, lost livelihoods, medical costs, and undetermined psychological impacts. Human deaths caused by rabies are estimated at 59,000 annually, particularly 40% occurring in children among poor rural societies in Africa and Asia (GARC, 2023; Swacita et al., 2023; Aptriana et al. 2024).

Rabies in Indonesia was first reported in West Java in the late 19th century. In subsequent decades, it was also reported from the other major islands (Directorate of Livestock and Animal Health, Ministry of Agriculture Republic Indonesia, 2019). Human rabies cases are mostly caused by dog bites, with approximately 82,634 dog bite cases reported annually (Ministry of Health Republic Indonesia, 2023).

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Dompu District, West Nusa Tenggara Province, was free of rabies until an incursion in 2019 and is now endemically infected. A total of 3493 cases of dog bite are registered by Dompu District Health Office, during 2019 to 2023. In early 2023, dog bite victims mainly occurred in children under the age of 15 years, which is categorized as elementary school-age. Children are unaware of stray dogs around schools and residential areas, so they often become victims of dog bites (Aung et al., 2021; Hien et al., 2023). It is also due to a lack of knowledge of children about rabies. Therefore, educating children about dog bite-associated rabies is crucial, as their participation is critical to reducing such incidents.

Rabies education for children was conducted using various educational interventions in several countries, such as one-hour educational interventions for school children in Sikkim, India (Auplish et al., 2016), rabies education information sessions and text messages in China (Wu et al., 2016), a campaign of "edutainment" for elementary students in Sri Lanka (Kanda et al., 2014), rabies awareness campaign in Bogor, Indonesia that involves posters and leaflets (Utomo et al., 2018), school-based information and education campaign (IEC) program for a private school in Davao City, Philippines using brochure, video, and lecture method (Lachica et al., 2021). Rabies education for elementary students using rabies game hunter in Sarawak, Malaysia was also carried out (Halim et al., 2021). However, that method was focused on the facilitators, so there was relatively less interaction between students. Consequently, student-centered rabies learning has not been widely practiced.

Therefore, this study implemented collaborative learning with a problem-based learning approach to raise students' memory and understanding of rabies, thus pushing them to be aware of it. The present study aimed to analyze the knowledge of rabies among students after intervention using the collaborative learning method. The findings of this study provide crucial information for decision-makers in Indonesia, especially in the endemic areas, to support their work in implementing the rabies awareness community based on collaborative learning in schools for rabies control.

MATERIALS & METHODS

Ethical Approval

The ethical clearance of this study was established by the Human Research Ethics Committee of IPB University with reference number 1151/IT3.KEPMSM-IPB/SK/2024.

Study Period and Location

This study was conducted from February to April 2024 in Public Elementary Schools in Dompu and Woja Sub-district, Dompu district, West Nusa Tenggara Province, Indonesia (Fig. 1). It is in the central part of Sumbawa Island with an area of 2,321.55 km^2. The district focuses on the livestock, agriculture, and fisheries sectors (Dompu District Government, 2023).

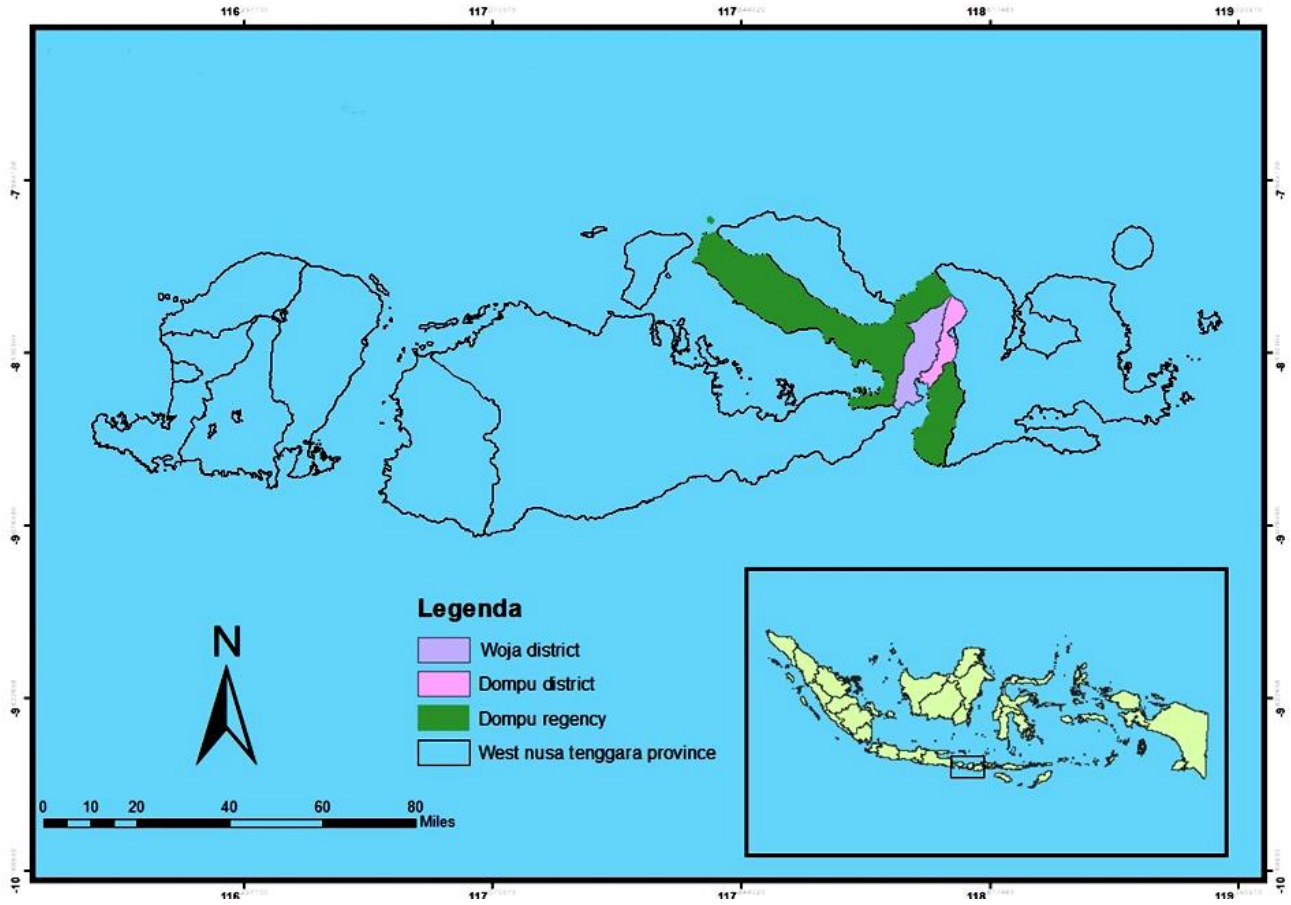

Fig. 1: Maps of Research Location in Dompu District West Nusa Tenggara Province, Indonesia (Source: generated by QGIS 3.28).

Study Design

The design of this research was used in a quasi-experiment with a pre-test and post-test (Harris et al., 2006). A pre-test was conducted before the intervention to measure student's baseline knowledge about rabies. Intervention in the study group used the collaborative learning method, and the control group used the lecture method. The post-test was conducted thrice on the same day (post-test-1), one week (post-test-2) and one month (post-test-3) after the intervention.

The intervention was implemented using the collaborative learning method, which provided an opportunity for students to discuss information about rabies with their groups. The results of the discussion were written and drawn on student worksheets. Next, each group presented their work to the other groups. In addition, in the control group, the lecture method was conducted face-to-face with students focused on the facilitator. The rabies material was presented as slides as supporting media for learning and ended with a question-and-answer session.

Respondent

The study sites were determined by purposive sampling (Swedberg et al., 2022). It was in public elementary schools with the most dog bite cases. Four schools were selected for the study, two in the Dompu sub-district and two in the Woja sub-district, each with one treatment and one control school. Respondents were all 5^{th} and 6^{th} grade students in the four schools, which consisted of 57 intervention group students and 49 control group students.

Data Collection

Data was collected using a structured questionnaire that students completed on the pre-test and post-test (Swedberg et al., 2022). The variables included the students' characteristics and students' rabies knowledge scores. The student's characteristics included gender, father's occupation, dog ownership information, experience access information on rabies and source of access to rabies information. The students' knowledge included a basic understanding of rabies, its causes and symptoms, how to avoid dog bites, and how to care for a dog properly. In addition, the pre-test and post-test results of students' rabies knowledge were used to measure the effectiveness of the learning methods used in rabies education.

The questionnaire used in this study was previously tested for validity and reliability using Pearson correlation and Cronbach's alpha. The questionnaire to measure students' knowledge level has three answer options: true, false, and not know. If the answer is true, it is given a value of 1. If the answer is false and unknown, it is given a value of 0. Elementary students' knowledge level was assessed based on poor, moderate, and good categories (Wicaksono et al., 2017; Suherman et al., 2023; Javed et al., 2023). The level of knowledge of elementary school students was assessed based on the categories of poor, moderate, and good. The score is considered good if the subject answers 76-100% of the questions correctly. The score is considered moderate if the subject answers 56-75% of the questions correctly. The score is considered poor if the subject answers less than 56% of the questions correctly (Wicaksono et al. 2017; Suherman et al. 2023).

The effectiveness of the learning method is objectively determined based on the n-gain score. According to Hake's formula, the n-gain score is the calculated improvement in knowledge score between the pre-test and post-test scores, compared to the difference between the ideal and pre-test scores. The effectiveness of the learning method is assessed based on low, moderate, and high categories (Nisa et al., 2022).

Statistical Analysis

Improving scores of elementary students' knowledge about rabies were analyzed using an independent sample t-test. The association between students' characteristics and rabies knowledge scores was analyzed using chi-square (Petrie and Watson, 2013). The effectiveness of the learning method was analyzed using Hake's formula (Nisa et al., 2022).

RESULTS

Sociodemographic Characteristic

Student characteristics data showed that the number of males and females was the same. Most of the students' fathers' occupations are farmers, while other occupations include civil servants, traditional sellers, drivers, and laborers. In general, the dog ownership of students was none. Only a few students had dogs. The number of dogs owned was between one and five dogs. Most students had accessed information about rabies, and sources of information were parents and teachers. Some students obtained information about rabies through other approaches, such as discussions with friends, watching television, and reading books about rabies. The details of the characteristics of elementary students are shown in Table 1.

Association between Sociodemographic Characteristics and Rabies Knowledge

Generally, students' knowledge about rabies was categorized as good (Table 2). All students already knew that rabies is a mad dog disease spread through the bite of a rabies-infected dog. Most students understood that rabies is a fatal disease, but only a few knew that a virus causes rabies. Regarding the symptoms of rabies, more than half of the students understood that a rabid dog fears water and light and bites everything around it. Half the students understood that the first treatment after a dog bite was washing the wound with running water and soap for 15min.

Regarding actions taken if chased by a dog, most students answered that they were running. Along with the actions taken when being chased by a dog, students understood how to avoid dog bites by not disturbing dogs, such as throwing stones and other objects, disturbing dogs that are eating, and not alarming dogs with puppies. In addition, only a portion of students knew that routine dog vaccination can prevent rabies transmission. Students learned how to properly care for a dog by giving it enough

Table 1: Characteristics of elementary school students in Dompu District, West Nusa Tenggara Province, Indonesia

Variable	Characteristics	Group				Total	
		Intervention (n=57)		Control (n=49)			
		Frequency	%	Frequency	%	Frequency	%
Gender	Male	24	42.1	29	59.2	53	50.0
	Female	33	57.9	20	40.8	53	50.0
Father's occupation	Farmer	44	77.2	32	65.3	76	71.7
	Civil servants	6	10.5	6	12.2	12	11.3
	Others	7	12.3	11	22.4	18	16.9
Dog Ownership	Yes	49	86.0	44	89.8	93	87.7
	No	8	14.0	5	10.2	13	12.3
Total dog ownership	1-5 dogs	49	86.0	44	89.8	93	87.7
	None	8	14.0	5	10.2	13	12.3
The purpose of keeping dogs	Guard of plantation/house	49	86	44	90	93	88
	None	8	14.0	5	10.2	13	12.3
Experiences access to rabies information	Yes	8	14.0	4	8.2	12	11.3
	No	49	86.0	45	91.8	94	88.7
Source of access rabies information	None	10	17.5	4	8.2	14	13.2
	Parents/teachers	43	75.4	23	46.9	66	62.2
	Others	4	7.0	22	44.9	26	24.5

n=number of students.

Table 2: Knowledge level frequency and percentage of elementary school students in Dompu related to rabies

Category	Frequency	Percentage (%)
Poor	18	17
Moderate	35	33
Good	53	50
Total	106	100

food and water and keeping it in a cage.

The association between characteristics of elementary students and rabies knowledge was measured using pre-test data. Students' sociodemographic characteristics generally had no significant association with students' knowledge (P>0.05) as presented in Table 3. The variable associated with the student's rabies knowledge was the source of rabies information.

The Effectiveness of the Collaborative Learning Method

The knowledge score of elementary students in the intervention group increased on the same day, one week, and one month after the intervention (Table 4). The results indicate that implementing collaborative learning methods has increased students' knowledge about rabies. It was influenced by students' interest in interacting with other students, creating conducive learning conditions. In addition, students' strong motivation encouraged them to learn and find out more about rabies from other sources. The same as the student's rabies knowledge score in the control group was increased (Table 4). The results of this study indicate that health education using collaborative

Table 3: Associations between characteristics of elementary school students in Dompu and level of knowledge about rabies

Characteristics	Characteristics categorized	Knowledge categorized (n=106)		χ^2	P-value
		Good	Moderate + poor		
Gender	Male	27	26	0.038	0.846
	Female	26	27		
Parent's occupation	Farmers	35	41	3.474	0.176
	Civil servants	9	3		
	Others	9	9		
Dog ownership	Yes	5	8	0.789	0.374
	No	48	45		
Total of dog ownership	1 to 5 heads	5	8	0.789	0.374
	None	48	45		
The purpose of dog care	Corn-field guardian animal	5	8	0.789	0.374
	Not know	48	45		
Experience on accessing information about rabies	Yes	50	44	3.383	0.066
	No	3	9		
Source of rabies information	Parents/teachers	32	34	8.478	0.014*
	Others	18	8		
	Not know	3	11		

n=number of students; χ2: chi-square results; (*): indicate significant association P<0.05.

Table 4: Independent t-test results based on knowledge scores of elementary school students in Dompu about rabies after the intervention

Variables	Mean±SD	Mean difference (95% CI)	P-value
T1: Post-test-1			
Treatment score (n=57)	24.91±19.28	17.56 (10.87–24.25)	<0.001*
Control score (n=49)	7.35±14.68		
T2: Post-test-2			
Treatment score (n=57)	27.54±21.57	16.52 (11.00–24.12)	<0.001*
Control score (n=49)	11.02±14.75		
T3: Post-test-3			
Treatment score (n=57)	29.30±21.20	19.09 (11.58–2660)	<0.001*
Control score (n=49)	10.20±17.14		

SD: Standard deviation; CI: Confident interval; Post-test-1: measuring time of knowledge score on the same day after intervention; Post-test-2: measuring time of knowledge score after one-week intervention; Post-test-3: measuring time of knowledge score one month after intervention; (*): indicate significant difference at the 95% CI.

learning and lecture methods improves students' understanding, memory, and awareness about rabies.

The implementation of collaborative learning and lecture methods as a delivery method for rabies education is shown in different categories (Table 5). The collaborative learning method has a highly effective categorization compared to the lecture method, which showed moderately effective categorization. It is indicated that the collaborative learning method is effective for rabies education in elementary students. In contrast, the lecture method obtained an n-gain score, which was concluded to be a moderate category. Although in the moderate category, the lecture method can still be combined with collaborative learning methods to improve students' understanding about rabies.

Table 5: The effectiveness categorized learning methods for rabies education among elementary school students in Dompu District, West Nusa Tenggara Province, Indonesia

Learning method	Measuring time	N-gain Score	95% CI	Category
Collaborative learning	Post-test-1	0.7	0.6-0.8	Effective
	Post-test-2	0.8	0.6-0.9	Effective
	Post-test-3	0.8	0.7-0.9	Effective
Lecture	Post-test-1	0.3	0.1-0.4	Moderately Effective
	Post-test-2	0.4	0.3-0.6	Moderately Effective
	Post-test-3	0.4	0.2-0.6	Moderately Effective

CI=Confident Interval; Post-test-1: measuring time of knowledge score on the same day after the intervention; Post-test-2: measuring time of knowledge score after one week of the intervention; Post-test-3: measuring time of knowledge score one month after the intervention; High: effectiveness category based on n-gain score >0.7. Moderate: effectiveness category based on n-gain score between 0.3-0.7.

DISCUSSION

Rabies is a neglected disease that urgently needs to be controlled. Globally, 99% of rabies cases are caused by dogs (WHO, 2023). It is fatal for victims who received treatment at the wrong time (Budayanti, 2020). Rabies can be prevented through dog vaccination, but public awareness is still low, causing rabies cases in the world to remain high, especially in children less than 15 years old (GARC, 2023). Improving children's knowledge about rabies influences their positive attitude to realize that rabies is a dangerous disease, but it can be prevented.

Based on the results of present study, the characteristics of elementary school students in the Dompu District generally had no association with the students' rabies knowledge, excluding the source of rabies information. According to Aung et al. (2021), in principle, sociodemographic characteristics had no association with the level of rabies knowledge. Consequently, it does not impact the increasing individual's understanding of learning. Most rabies information was obtained from parents and teachers. It indicates that the participation of parents and teachers is essential to improve children's knowledge about rabies. The participation of parents at home and teachers at school is essential as a collaborative team in disease prevention (Khusniyah et al., 2023). Rabies control is inseparable from the level of public awareness (Prasanjaya et al., 2020). It confirms that rabies education in elementary school children as a community element is vital in reducing dog bite cases. Moreover, improving children's understanding in schools through a rabies learning approach significantly impacts rabies control implementation (Laorujisawat et al., 2022).

Collaborative learning is participant-centered learning practiced globally. This learning method improves members' participation in understanding information and participants with basic learning information shows significant results (Kustiningsih et al., 2023). Based on field simulation, Mustaffa-Kamal et al. (2023) used a problem-based learning approach in health education with a one-health approach, enhancing positive learning experiences for in-school students. It facilitated interaction between students. The knowledge score of elementary students increased, which indicated that the implementation of collaborative learning encouraged students to learn and explore other sources of information, thus improving their knowledge about rabies. According to Hasan (2021), it was caused by the capacity of elementary students on the operational concrete stage to accept suggestions and information that is more comfortable to store in long-term memory. On the other hand, students were still exposed to rabies information because their assignments were posted on the classroom wall as learning media, influencing their capacity to memorize and understand information about rabies. According to Utomo et al. (2018), using media in the rabies learning process shows a situation almost the same as the actual situation to the target. Xie and Deng (2023) reported that children who drew pictures and were exposed to the learned information more frequently increased their motivation to learn and significantly improved their memory of learning information.

Implementing the lecture method increased the rabies knowledge score of elementary school students. The lecture method was chosen as the control because it is the most common and widely used method in various lessons, including learning about rabies. According to Kanda et al. (2014), the knowledge level of elementary students increased by using the lecture method in health promotion about rabies. In addition, after educational intervention using the lecture method with audio-visual for 30 minutes on topics covering rabies epidemiology, clinical features, prophylaxis, management, and program guidelines, followed by a short 30-minute short film, there were statistically significant improvements in the rabies knowledge scores of elementary schools (Manoharan et al., 2023). However, the lecture method has the disadvantage that students become passive, and the material presented is complicated to remember in long-term memory (Utomo et al., 2018).

Based on the results of the present study, the implementation of collaborative learning for rabies education among elementary students was categorized as highly effective. This method may last longer because the students participate in the learning process, so the level of knowledge continues to enrich information (Kustiningsih et al., 2023). Besides that, the lecture method was categorized as moderately effective. Learning effectiveness depends on the interactions between students and teachers in an educational situation to achieve learning objectives (Kanda et al., 2014). Using

media in learning helps to complete all aspects to achieve development of student (Khusniyah et al., 2023).

The knowledge scores of elementary school students using collaborative learning and lecture methods have increased significantly. It was influenced by the short duration of measurement, which is one month, so it still shows a significant increase. However, it is essential to realize that factors beyond the scope of this study may significantly affect students' knowledge scores. Therefore, future research is needed to extend the measurement time to understand significant changes in rabies knowledge scores of elementary school students.

Conclusion

The collaborative learning method used for rabies education among elementary school children in Dompu significantly improved rabies knowledge scores and encouraged awareness of stray dogs as potential rabies host animals. The effectiveness of this method in improving elementary school children's knowledge and attitudes about rabies is well-established, providing reassurance about its potential in rabies education.

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