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Implementation of Biology Learning by Utilizing The Local Potential of The Citarum River to Increase Students' Environmental Literacy on Environmental Change Material

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Abstract: This study aims to increase students' environmental literacy through the implementation of biology learning by utilizing the local potential of the Citarum River on environmental change material. The research method used is Quasi-experimental. The population in this study were all environmental literacy abilities of class X students of SMA Negeri 1 Baleendah, while the sample in this study was the environmental literacy of class X students of SMA Negeri 1 Baleendah which consisted of two classes as an experimental class and a control class totaling 88 people. The instruments used consisted of multiple choice questions for indicators of environmental literacy, knowledge and cognitive skills, and questionnaires for responsible attitudes and behavior indicators. The results showed that from the pretest and posttest scores there was an increase in scores on indicators of knowledge and cognitive skills seen from the average Ngain in the experimental class of 0.60 which could be categorized as medium and the control class was 0.45 which was categorized as medium. For indicators of responsible attitudes and behavior, the average Ngain score in the experimental class is 0.50, categorized as medium, and in the control class is 0.26, categorized as low. So it can be concluded that the implementation of biology learning by utilizing the local potential of the Citarum River can increase students' environmental literacy.

Keywords: Citarum; Environmental Literacy; Local Potential.

Introduction

The implementation of the learning process by utilizing local potential as a learning resource is still not optimal, teachers often use learning resources in the form of textbooks obtained from publishers without being further developed according to local potential in the area. Therefore learning without integrating local potential can reap obstacles because the concepts and principles in learning will be difficult to implement in everyday life by students (Wulandari & Djukri, 2021). This causes the low knowledge of students about the environment.

River water pollution is one of the biggest environmental problems, especially in developing countries like Indonesia. If properly utilized river water plays a role in domestic activities, industry, agriculture and animal husbandry as well as recreation. But today polluted rivers can cause disease and emit odors and even rivers can overflow and cause flooding. Rivers are very important environmental components so that people must be able to maintain their sustainability and cleanliness, rivers can provide ecosystem functions and services that can sustain the balance of biodiversity and human welfare. (Singh & Verma, 2019).

One of the polluted rivers in Indonesia is the Citarum river in West Java. The contamination of the Citarum River is caused by the many industries that have been established around the Citarum River Basin (DAS). It is estimated that 2,700 industries are unable to process the waste they produce so that they have the potential to dispose of this waste directly into the

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Citarum River (Sholeh et al., 2018). The Citarum River is the longest and largest river in West Java. This river is one of the local potentials because it has a strategic role in supporting and prospering the community. If utilized properly, the Citarum River can supply drinking water, sources of agricultural irrigation, aquaculture and ecotourism (Pantjawati et al., 2020). The Citarum River is also used as a source of electricity generation (hydroelectric power plant). The Citarum River can drain 420 thousand hectares of rice fields which are rice barns in West Java Province and supply nearly 80% of Jakarta's clean water needs (Sholeh et al., 2018).

The Citarum River is included in the national strategic river area. The government's effort to maintain the local potential of the Citarum River is by issuing (Keputusan Presiden RI Nomor 12, 2012) which states that the river is a national strategic area. The Citarum River as a local potential must be preserved so that it can continue to be utilized for the benefit of the community, local potential is a certain resource owned by an area including natural and cultural resources (Destiara, 2020).

Learning based on the local potential of the Citarum River as one of the efforts in the field of education in participating in maintaining the environmental balance of the Citarum River and to support curriculum demands that refer to (UUSPN No 20, 2003) learning by utilizing local potential can shape students' understanding of excellence and wisdom in the area where they live and make the learning process more applicable and meaningful (Permendikbud, 2014). Utilizing local potential in learning can help students learn biology with real-life learning that is close to everyday life and can add to learning material (Ismiati, 2020). Integrating local potential as a learning resource that can display real objects and examples found around students is able to influence attitudes and concern for the environment. Integrating local potential as a learning resource can display real objects or examples found around students, this can influence students' attitudes and concern for the surrounding natural environment for a better (Adawiyah et al., 2020).

To support students who care about the environment, they can integrate environmental education into the learning process and support the achievement of the Sustainable Development Goals program. According to (Goldman et al., 2006) Environmental education is very important to be integrated into learning, awareness of the environment should be instilled from an early age in formal education. The education system must be able to produce citizens who are aware of the surrounding environment and have sufficient knowledge and have responsible behavior towards the environment, this underlies the importance of integrating environmental literacy in the curriculum (Saribas, 2015).

An important literacy ability to grow in Indonesia is environmental literacy. Indonesia is a country with different natural resources and local potentials in each region, if it is not maintained it will be damaged and threaten human life (Leksono et al., 2020). One of the efforts to develop environmental literacy skills can be done through formal education. Environmental literacy possessed by a person can support efforts to overcome the environment, a person who has environmental literacy is defined as a person who has environmental knowledge effectively, and can act consistently in adjusting the balance of quality of life and quality of the environment (Kaya & Elster, 2019).

The current educational challenge is that learning must be able to introduce students to the importance of the surrounding environment and students must be able to implement the results of the learning process in everyday life, learning is not enough if it is only able to provide knowledge, therefore learning must be equipped with literacy skills.

Environmental literacy has components and aspects that make up environmental literacy, these domains that make up environmental literacy, namely knowledge of the environment and ecology, cognitive skills, attitudes and responsible behavior towards the environment so that the components of environmental literacy are categorized as consisting of cognitive aspects, namely knowledge and skills. and affective namely attitude and behavior of responsibility towards the environment (Spinola, H., 2015).

Environmental literacy is an act of awareness of the environment and is a basis for knowledge, skills and motivation to address environmental problems and contribute to sustainable development (Ilhami et al., 2019). The ability of environmental literacy possessed by a person is a factor in overcoming various current environmental problems, with environmental literacy skills, the person can care for the environment and is able to solve environmental problems, while the concept of environmental literacy is emphasized on three aspects such as nature, environmental problems and solutions that can be given in solving environmental problems (Wardani et al., 2018).

Students' environmental literacy is still considered low due to several factors, one of which is the low willingness of students to know and learn about environmental problems (Nasution, 2016). The ability of environmental literacy that is still low can be caused by the absence of a school environment that is able to provide direct learning experiences for students to interact with the environment (Istikomayanti et al., 2016). Therefore the effort to increase students' environmental literacy is through the implementation of

biology learning by utilizing the local potential of the Citarum River to increase students' environmental literacy.

Method

The research method used in this study is a quasi-experimental method. The purpose of this method is to find the effect of a certain treatment on another with controllable conditions. The population in this study were all environmental literacy abilities of class X students of Baleendah State Senior High School, while the sample in this study was the environmental literacy ability of class X students of Baleendah 1 Public High School consisting of two classes with a random sample selection technique (Cluster Random Sampling), namely class X MIA 8, totaling 44 students as the control class and class X MIA 9, totaling 44 students as the experimental class. This research was conducted in Baleendah District, Bandung Regency because in this District there is a Citarum river flow which is a local potential. And SMA Negeri 1 Baleendah which is a school that is located quite close to the local potential of the Citarum River so that the implementation of learning by utilizing the local potential of the Citarum River is carried out at SMA Negeri 1 Baleendah which is located at Jl. RAA Wiranatakusumah No. 30 Baleendah Bandung Regency. This study aims to determine the effect of learning biology by utilizing the local potential of the Citarum River to increase students' environmental literacy. The design of this study used a pretest-posttest nonequivalent control group design. In this design, there were control and experimental classes. In this study the experimental class used the biology learning method by utilizing the local potential of the Citarum River for environmental change material, while the control class used biology learning methods in accordance with teaching materials at school and not sourced from the Citarum River for environmental change material taught to students. After the different learning treatments have been carried out, observations will be made of the experimental subjects. The research design can be seen in the Table 1.

Table 1. Research Design

Class	Pre-test	Treatment	Post-test
Experiment	X_1	Y_1	X_2
K+Control	X_1	Y_2	X_2

Note:

X_1: Pretest scores before applying biology learning by utilizing the local potential of the Citarum River in the experimental class.

X_1: Pretest scores before applying biology learning by utilizing the local potential of the Citarum River in the control class.

X_2: Posttest scores after applying biology learning by utilizing the local potential of the Citarum River in the experimental class.

X_2: Posttest scores after applying biology learning by utilizing the local potential of the Citarum river in the control class.

Y_1: Application of biology learning by utilizing the local potential of the Citarum River on environmental change material.

Y_2 : The application of biology learning does not take advantage of the local potential of the Citarum River as a source of learning on environmental change material.

Data collection in this study was carried out using several instruments consisting of tests and non-tests. For the components of environmental literacy, knowledge and cognitive skills, the instruments used were 20 multiple choice test questions adapted and modified from the Middle Schools Environmental Literacy Survey/Instrument (MSELS/I). Which has been developed by the National Environmental Literacy Assessment while for environmental literacy the components of attitudes and responsible behavior use a questionnaire with a Likert scale. The environmental literacy instrument is prepared based on the environmental literacy test grid listed in Table 2.

Table 2. Environmental Literacy Test Instrument Grid

Environmental Literacy Components	Indicators
Knowledge	Explain the meaning of environment and environmental change.
	Describe the impact and pollution of the environment.
	Identify environmental changes that occur.
	Create an effort idea in environmental preservation.
Cognitive Skills	Identify environmental problems.
	Analyze environmental problems.
	Plan environmental investigations.
Attitude	Thoughts on the environment.
	Have awareness of the environment.
	Have solutions to environmental issues.
Environmentally responsible behavior	Responsible for the environment, carrying out activities in the framework of overcoming environmental problems.

(Source: NAAEE, 2011)

Before the test instrument is given, it will be judged by a team of experts and tested for validity, reliability, level of difficulty, and discriminating power using the help of the ANOTES application. After the questions are declared fit for use, the instrument will be tested on students in the form of a pre-test before learning and post-test after learning, then data on students' pre-test

and post-test scores are analyzed using a statistical test in the form of a prerequisite test consisting of a normality test and a homogeneity test. Statistical tests were carried out using the SPSS V.24 application after the prerequisite test continued with the Hypothesis Test with the provision that if the data is said to be normal and homogeneous then use the parametric hypothesis test, namely the T Test with Decision making is carried out by looking at the significance value in the Coefficients table. There are results of regression testing carried out with a confidence level of 95% or with a significance level of 5% (α = 0.05) while the decision making on the T test is as follows: 1. If the significance value of the t test > 0.05 then Ho is accepted and Ha rejected. This means that there is no influence between the independent variables on the dependent variable. 2. If the significance value of the t test <0.05 then Ho is rejected and Ha is accepted, meaning that there is an influence between the independent variables on the dependent variable. Meanwhile, if the data is not normal/homogeneous then use the non-parametric hypothesis test, namely the ManWhetney test.

To see whether there is an increase in students' environmental literacy from the implementation of biology learning by utilizing the local potential of the Citarum River is the N Gain Test. This test was carried out aiming to determine the increase in students in learning after being given treatment in the learning process. This increase can be seen or taken from the students' pretest and posttest scores. To calculate the value of N Gain, it can be seen in Equation 1.

$$\text{N Gain} = \frac{\text{Skor } Postest - \text{Skor } Pretes}{\text{Skor } Maksimal - \text{Skor } Pretes} \quad (1)$$

Table 3. N-Gain Value Criteria

Nilai N-Gain	Pretest
0.00< N – Gain < 0.30	Low
0.30< N – Gain<0.70	Medium
N-Gain > 0.70	Hight

Result and Discussion

There are many local potentials that can be integrated into learning biology, so that it can have an impact on students in developing the ability to express facts that exist in their environment. (Situmorang, 2016).

Learning biology by utilizing the local potential of the Citarum River is taught to students on environmental change material. Students plan observations to find out environmental changes and environmental issues in the Citarum River, then students carry out direct biology lessons in the Citarum River by observing environmental changes and the causes of environmental changes in the Citarum River so that students are able to provide solutions to environmental problems in the Citarum River. By learning biology that utilizes the Citarum River as a source of learning on environmental change material, it is hoped that students will have good environmental literacy skills. Everyone should have environmental literacy (Hollweg, 2011). Environmental literacy is an act of awareness of the surrounding environment, environmental literacy of how to behave and be responsible for the environment (Kusumaningrum, 2018). After carrying out biology learning by utilizing the local potential of the Citarum River, the environmental literacy skills of Baleendah 1 Public High School students on each indicator of environmental literacy varied. The results of the environmental literacy analysis of class X high school students on environmental change material can be seen in Figure 1.

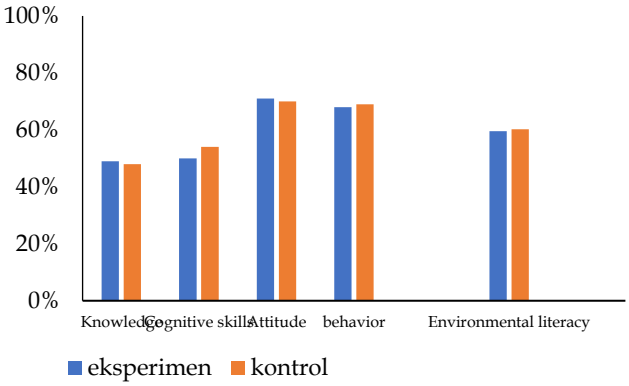

Figure 1. The average value of students' Environmental Literacy Pre Test in the experimental class and the control class.

Based on Figure 1, there is a difference in the average pre-test scores or initial abilities in the control class and the experimental class. Initial ability shows the average value of environmental literacy pretest experimental class students for indicators of knowledge and cognitive skills of 49% and 50%. Whereas in the control class the average scores on indicators of knowledge and cognitive skills were 48% and 54%. For the average percentage of affective abilities, namely attitude and behavior of responsibility for the experimental class, namely 71% and 68%. For the initial ability control class for indicators of attitude and behavior of responsibility by 70% and 69%. It can be seen in the percentage of initial abilities for the experimental class and the control class that there is not much difference between the initial abilities of the experimental class and the control class, namely the overall average environmental literacy ability of the experimental class and the control class is 60% which is classified as medium criteria. so a post test was carried out to see the difference in ability that occurred after the

implementation of biology learning by utilizing the local potential of the Citarum river.

After carrying out biology learning by utilizing the local potential of the Citarum River on environmental change material, there was an increase in the average pre-test value. In the following, the average post-test scores or final environmental literacy skills in the experimental class and control class will be presented as shown in Figure 2.

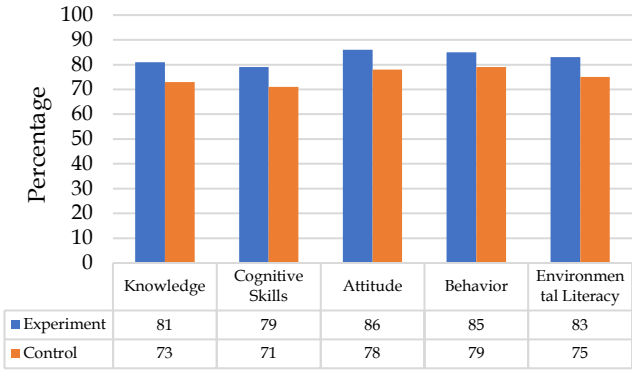

Figure 2. Rata- rata Nilai Post Test Literasi Lingkungan siswa pada kelas eksperimen dan kelas kontrol

Based on the above diagram for the final ability of students' environmental literacy on indicators of knowledge and cognitive skills in the experimental class by 81% and 79%. While in the control class for indicators of knowledge and cognitive skills by 73% and 71%. In the affective indicators, namely attitudes and behavior of responsibility, the percentage of final ability in this aspect for the experimental class was 86% and 85%, while for the control class, the indicators for attitudes and behavior indicators were 79% and 75%. From the average percentage of initial ability and final ability of environmental literacy data there are differences and improvements, for the experimental class the average environmental literacy ability of 83% can be said to be good and the average environmental literacy ability of the control class is 75% and is classified in the good category . then you can see the increase based on the Gain calculation. The following will be presented in table 4 and table 5, will present a summary of the data from the pre-test and post-test results and a summary of the increase in environmental literacy skills represented in Table 4.

Based on the table above, the average pretest value for the experimental class is 49 and the control class is 50. After learning biology by utilizing the local potential of the Citarum River for the experimental class, it can be seen that the average posttest value for the experimental class is 81 and for the control class is 73. There is increase in average value in the experimental class.

Table 4. Data Recapitulation of Pretest and Posttest Multiple Choice Environmental Literacy Ability Indicators of Knowledge and Cognitive Skills

Component	Experiment		Control	
	Pre-test	Post-test	Pre-test	Post-test
The number of students		44		44
Average Value	49	81	50	73
Maximum Value		100		100
Minimum Value		0		0
Standard Deviation	11	7	12	9

Table 5. Recapitulation of Increasing Environmental Literacy Ability Indicators of Knowledge and Cognitive Skills

Component	Experiment		Control	
	Preetest	Posttes	Preetes	Posttest
Highest Gains		70		55
Lowest Gain		10		5
Average Gain		31		23
Ngain Average	0.60 (Medium)		0.45 (Medium)	
Distribution of Ngain Category				
Tall	27% (12 people)		5% (2 people)	
Currently	68%(30 people)		73% (32 people)	
Low	5% (2 people)		23% (10 people)	

The increase in environmental literacy skills in the experimental class and control class can be seen in table 5, namely the average gain in the experimental class is 31 and the control class is 23. The increase between the experimental class and the control class is quite different. The distribution that has a level of environmental literacy ability in the experimental class with a high category is 12 people, 30 people are medium and 2 people are low. In the control class the level of environmental literacy has a high category of 2 people, 32 people are medium and 10 people are low. Utilization of local potential in learning can make it easier for students to understand the lesson because students are able to observe and find facts in the environment directly besides that the use of local potential in learning can provide a relationship between the knowledge students have and its application in life (Fitriyani et al., 2021).

Utilization of local potential in the learning process can improve and facilitate the ability of content, context, and students' scientific thinking processes so that this can support the achievement of complete student learning outcomes (Abidinsyah et al., 2019). For environmental literacy indicators, attitudes and behavior are responsible for the environment using a questionnaire. Of the 20 question items for the environmental literacy questionnaire, 17 items are

included in the attitude indicator and 3 question items represent indicators of responsible behavior towards the environment. The achievement of environmental literacy skills in the attitude component is seen based on the average percentage of students who respond to positive or negative statements after applying biology learning by utilizing the local potential of the Citarum River on environmental change material. The following is a recapitulation of the attitude components of students who respond to positive or negative statements:

Table 6. Recapitulation of Attitude Components Based on positive and negative responses in the Experiment class and the control class

Response	Percentage of total students (%)							
	Experiment				Controls			
	SS	S	TS	STS	SS	S	TS	STS
				Positive Statement				
	53	44	3	1	37	39	23	1
Average positive response (SS and S)				48				38
Average Positive response (TS and STS)				2				12
							Negative Statement	
Response	0	7	48	45	1	23	41	35
Average Negative response (SS and S)				4				12
Average Negative response (TS and STS)				46				38

The questionnaire in this study had positive and negative statements, in the experimental class for positive response statements strongly agreed and agreed by 48% and the control class was 38%, while positive statements for disagreed answers in the experimental class were 2% and the control class were 12%. For negative statements, the responses strongly agreed and agreed in the experimental class were 4% and the control class were 12%, while the average negative response for the answers disagreed and strongly disagreed was the experimental class by 46% and the control class 38%. Judging from the average percentage of student responses to the environmental literacy questionnaire, there is a difference between the experimental class and the control class. The experimental class has a higher concern for the environment.

Attitude is a basis for determining responses and behavior, so that students' attitudes towards the environment can influence students' responsible behavior towards the environment (Rokhmah & Fauziah, 2021).

One way to increase students' sensitivity to the environment is to integrate local potential in learning, the environment can provide a learning experience for students (Ilhami et al., 2019). Local potential which is utilized as a learning medium can support students in understanding concepts and having an attitude of caring for the environment (Muthmainah et al., 2016). Environmental literacy can be trained to students through the environmental education system. So the implementation of biology learning by utilizing the local potential of the Citarum River can train students towards environmental literacy (Ardoin et al., 2020).

The environmental literacy questionnaire for indicators of responsible behavior towards the environment also consists of positive and negative statements. Following is a recapitulation of student responses to questions of responsible behavior towards the environment.

The environmental responsibility behavior questionnaire consists of positive and negative statements, based on Table 7 for the average percentage of positive statements strongly agree and agree for the experimental class is 49% and the control class is 37% while for positive statements disagree and strongly disagree agreed that the response of students in the experimental class was 1% and the control class was 13%. The negative statements for the answers strongly agree and agree in the experimental class are 4% and the control class are 15%, while the negative statements disagree and strongly disagree in the experimental class are 46% and the control class are 35%. Based on the recapitulation of students' responses to indicators of environmentally responsible behavior in the experimental class, the experimental class had a higher environmental responsibility attitude than the control class. To make it clearer, a table of increasing values will be presented for the attitude and behavior indicators of responsibility for the experimental class and the control class.

Table 7. Recapitulation of Components of Responsible Behavior towards the Environment Based on positive and negative responses in the Experimental class and the control class

Response	Percentage of total students (%)							
	Experiment				Controls			
	SS	S	TS	STS	SS	S	TS	STS
								Positive Statement
	50	48	2	0	68	45	18	7
Average positive response (SS and S)				49				37
Average Positive response (TS and STS)				1				13
								Negative Statement
Response	1	7	49	43	2	27	31	40
Rata-rata respon Negatif (SS dan S)				4				15
Rata-rata respon Negatif (TS dan STS)				46				35

Table 8. Recapitulation of Increasing Environmental Literacy Ability Indicators of attitude and behavior of responsibility towards the environment

Component	Experiment	Control
Highest Gains	35	26
Lowest Gain	1	2
Average Gain	15	8
Ngain Average	0.50 (medium)	0.26 (low)
N-gain category distribution		
Tall	14% (6 people)	0% (0 people)
Medium	68%(30 people)	36% (16 people)
Low	18% (8 people)	64% (28 people)

Based on the table recapitulation of environmental literacy skills indicators of attitude and behavior of responsibility towards the environment, then for the experimental class the average gain is 15 and for the control class 8, while the average Ngain in the experimental class is classified as a moderate category of 0.50 and the control class is classified as a low category of 0.26. It can be said that learning biology by utilizing the local potential of the Citarum River in environmental change material that has been applied to the experimental class has an impact on attitudes and behavior that is much better responsible for the environment, students have good environmental literacy after implementing biology learning by utilizing the local potential of the Citarum River on environmental change.

Implementation of biology learning by utilizing the local potential of the Citarum River is considered more effective for teaching environmental change material and can increase environmental literacy and student concern for the environment. students can directly observe environmental changes that occur in the Citarum River and can provide solutions and countermeasures for environmental changes in the Citarum River. In learning biology students are not only required to understand material, concepts and facts but students must be able to carry out a discovery process that exists in the environment, therefore learning biology is required to implement the learning process with direct and contextual experience so that students are able to express facts in their environment. (Aisyah,N.S.M., et al., 2016).

Someone who has environmental literacy can be interpreted as a person who has environmental insight effectively, and is able to act consistently in balancing life with his environment, and individuals who have the ability to know the environment, attitudes and behavior of caring for the environment, that person has good environmental literacy (Kaya & Elster, 2019).

Conclusion

The results of this study indicate that the implementation of learning biology by utilizing the local potential of the Citarum river can improve the environmental literacy skills of class X SMA Negeri 1 Baleendah students. Environmental change material is taught to students by utilizing the Citarum river as a local potential in local areas that have experienced pollution so that students can directly observe environmental changes that occur in the Citarum River. After carrying out the learning, it can be seen that students' environmental literacy has increased based on pretest and posttest scores. It can be seen that there has been an increase in indicators of knowledge and cognitive skills. 60 can be categorized as moderate and the control class is 0.45 moderate category. For indicators of attitude and responsible behavior, there is an increase in the experimental class. It can be seen that the gain score is 15 and the control class is 8, while for the average Ngain value in the experimental class is 0.50, it can be categorized as a moderate increase and for the

control class it is 0.26. can be categorized as a low increase. Based on the average gain score, it can be concluded that the implementation of biology learning by utilizing the local potential of the Citarum River can increase students' environmental literacy.

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Author Contributions
Intan Khairani: writing-preparation of the original draft, results, discussion, methodology, conclusions; Saefudin and Amprasto; proofreading, reviewing, and editing.

Conflicts of Interest
The author declares no conflict of interest regarding the publication of this paper.

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