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CRITICAL THINKING AND COLLABORATION SKILLS ON ENVIRONMENTAL AWARENESS IN PROJECT-BASED SCIENCE LEARNING

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ABSTRACT

For prospective elementary education teachers, critical thinking and collaboration skills in project-based science learning can impact environmental awareness. Critical thinking and collaboration skills can affect prospective teachers' environmental awareness differently, especially in science learning with environmental material. This research aims to determine the effect of critical thinking and collaboration skills on environmental awareness. Correlational research was used to determine the relationship between the two variables. Research data was obtained from 114 prospective Elementary Education teachers at UIN Maulana Malik Ibrahim Malang through project-based learning. Assessment of critical thinking skills was based on reports or essays from projects undertaken. The collaboration instrument was based on rubrics and peer questionnaires. The environmental awareness instrument used a 27-item questionnaire. The questionnaire was measured using a Likert scale of 1 (strongly disagree) – 4 (strongly agree). The data obtained was tested using SEM to determine the effect of critical thinking and collaboration skills on environmental awareness. The research results show that critical thinking and collaboration skills positively affect environmental awareness. This is indicated by a P-value for critical thinking skills is 0.047 < 0.05 and a P-value for collaboration skills is 0 < 0.05. Collaboration skills have a stronger effect on environmental awareness than critical thinking skills (path coefficients = 0.766). Indicators of collaboration skills tend to emphasize the aspect of caring more about others and the surrounding environment. The suggestion for further research is needed to see the effects of other variables on environmental awareness in project-based science learning, such as creative thinking and communication skills.

Keywords: critical thinking; collaboration; environmental awareness

INTRODUCTION

It is essential to maintain the quality of the environment. Awareness is an important element in the living environment that everyone, including students and prospective teachers, must have. Students must be aware because they are the next generation who will protect the environment in the future (Dolenc-Orbanić & Kovač, 2021; Utaya & Wafaretta, 2021; Si et al., 2022). Meanwhile, as prospective teachers, students need to have concerns so they can later set an example for students. The quality of the environment is decreasing over time, causing a decline in the quality of human life (Brauman et al., 2020). The low quality of the environment at universities is caused by students' low awareness of the surrounding environment (Farmer et al., 2019; Si

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et al., 2022). It is proven by Amin et al. (2020) that concern for the campus environment among social studies education students is still relatively low. It was further explained that they did not care about the garbage scattered in the classroom and around the campus. Students' lack of knowledge about the environment and the importance of protecting the environment can hinder their awareness of preserving the environment (Si et. al 2022). In addition, Gurbuz and Ozkan (2019) state that environmental knowledge among students in Turkey is low, thus affecting a low level of environmental awareness.

Learning can foster environmental awareness (Paradewari et al., 2018; Demssie et al., 2023). One learning model that can foster environmental awareness is Project-based Learning (PjBL). PjBL is project learning based on problems in the surrounding environment (Retnowati et al., 2020; Stanley, 2021; Buroidah et al., 2023). This learning is very in line with the characteristics of environmental material. According to Khan et al. (2022), environmental material strongly connects to daily life and student problems (Khan et al., 2022). Learning based on environmental problems can provide direct experience and be more meaningful.

The stages in PjBL require critical thinking skills. Through high critical thinking skills, the project can be successful and provide the right solution to the problem. Several stages in PjBL developed by Krajcik and Czerniak (2018) are similar to the critical thinking indicators developed by Fisher (2013). Some of these stages focus on problem selection, identifying the facts of the problem, developing knowledge to provide appropriate and logical reasons or arguments, and selecting knowledge in an integrated manner to solve the problem or project being undertaken. Apart from that, the stages in PjBL developed by Krajcik and Czerniak (2018) are similar to the collaboration skills indicators in the National Council of Teacher rubric. Some of these stages are selecting problems, which are carried out together by sharing ideas and knowledge, examining knowledge related to the project and framework together with the group, completing project tasks together in groups, discussing and sharing opinions, thoughts, and ideas with other groups in performance assessment and project evaluation. This shows that it is possible for critical thinking skills and collaboration skills to provide a stronger push to increase environmental awareness in PJBL.

Prospective teachers with high critical thinking skills will more easily master, face, and solve environmental problems (Amin et al., 2020; Mercy et al., 2020; Ristanto et al., 2022; Suradika et al., 2023). According to Fisher (2013), the core of critical thinking skills includes identification, analysis, clarification, finding solutions, evaluation, and decision-making. Besides, critical thinking skills can improve prospective teachers' ability to form scientific arguments (Giri & Paily, 2020; Akbaş, 2021; Zahra et al., 2023). Increasing scientific argumentation skills will provide a more robust understanding of knowledge about the conditions of the surrounding environment. According to Kim (2019) and Farmer et al. (2019), understanding environmental knowledge is one indicator of increasing environmental awareness. Prospective teachers with critical thinking skills and a high understanding of the environment will have a more caring attitude toward the surrounding environment.

Much research has been conducted on critical thinking skills in learning. Several research results show a strong relationship between the PjBL model and critical thinking skills. According to Asmara et al. (2023), using project-based learning models effectively improves critical thinking skills. Improving critical thinking skills requires sufficient time allocation and projects carried out based on existing problems around them (Maksum et al., 2021; Wai & Lovett, 2021; Purwanto et al., 2022). Problem-solving through project learning can train critical thinking skills (Issa & Khataibeh, 2021; Boran & Karakuş, 2022; Ristanto et al., 2022). Critical thinking skills include identification, analysis, clarification, finding solutions, evaluation, decision-making (Fisher, 2013), and the structure of scientific argumentation (Giri & Paily, 2020).

In addition to critical thinking skills, collaboration skills are essential for prospective teachers in the 21st century (Yeşilçınar & Aykan, 2021; Ramsay-Jordan, 2022; Musarrat & Marium, 2023). Collaboration skills are needed to support prospective teachers in thinking critically and solving problems (Huysken et al., 2019; Barber et al., 2020; Warsah et al., 2021). Collaboration is done in groups to solve problems and build knowledge through balanced roles (Zambrano et al., 2019; Zhang et al., 2023). Collaboration skills can produce good learning outcomes with the help of peers in class (Heinimäki et al., 2020). Students who collaborate show positive things, for example, socio-cognitive roles and joint problem-solving (Dowell et al., 2020) and increased academic literacy and content knowledge (Moore et al., 2019). This shows that collaboration skills are an essential aspect to improve learning outcomes.

Collaboration in learning impacts learning outcomes (Salas-Rueda et al., 2021). Collaboration can strongly increase students' competencies (Ghavifekr, 2020) and develop thinking skills (Zhou, 2020). Collaborative interactions have the characteristics of sharing goals, reaching a high level in negotiations, and being interactive and interdependent (Falcione et al., 2019). Measuring collaboration skills should have clear objectives. This will positively impact learning outcomes (Harding et al., 2017; Abd-Mutalib et al., 2023). Increasing collaboration skills can foster a caring attitude through sharing knowledge (Wang & Liu, 2020; Jung et al., 2021), sharing solutions to problems (Kwon et al., 2019), and a willingness to interact in the surrounding environment (Ghavifekr, 2020). The positive impact of collaboration can not only increase learning outcomes but can also foster a caring attitude.

Although there has been research on project-based learning, critical thinking, and collaboration by Amin et al. (2020), Orhan (2022), Demssie et al. (2023), and Suradika et al. (2023), not much has been done to determine the impact of critical thinking skills and collaboration skills on the environmental awareness of prospective elementary education teachers in project-based science learning. In addition, environmental material in the context of science learning in prospective basic education teachers is a differentiator in this study. The application of project-based learning is adjusted to the problems in the surrounding environment to determine the impact of critical thinking and collaboration skills on environmental awareness.

Based on various theoretical and empirical studies, the researchers assume that critical thinking and collaboration skills in project-based science learning for prospective elementary education teachers can impact environmental awareness. Critical thinking skills can be used by prospective teachers in identifying and investigating problems (Mercy et al., 2020) as well as solving problems (Listiqowati et al., 2022). Meanwhile, collaboration skills will train prospective teachers to share ideas, thoughts, and knowledge (Williams et al., 2020), respect each other, and work together (Ramsay-Jordan, 2022). Critical thinking skills and collaboration skills can have a different effect on prospective teachers' environmental awareness. This research aims to determine the differences in the effects of critical thinking skills and collaboration skills on the environmental awareness of prospective elementary education teachers on environmental material.

METHODS

This research used quantitative correlation to determine the relationship between two variables (Creswell & Creswell, 2018): critical thinking skills and collaboration skills on environmental awareness. The population was 160 prospective elementary education teachers at UIN Maulana Malik Ibrahim Malang for the 2022-2023 academic year who were taking the Living Creatures and Environment course. Based on the Slovin formula (Uakarn et al., 2021), this research used 114 samples selected by random sampling from 160 populations. The PjBL model adopted the steps developed by Krajcik and Czerniak (2018). Learning was carried out by combining face-to-face in-class and outside the classroom. Learning in class was carried out through discussions, questions and answers, and presentations. Learning outside the classroom was carried out to identify and investigate environmental problems, collaborate with experts, and resolve solutions to problems. The syntax of project-based science learning in this study is presented in Table 1.

Table 1. Project Science-Based Leaning Model Syntax

Stage	Activity	Description
Environmental problem orientation	Lecturers provide explanations about the material and contextual environmental problems.	Face to face in class
	Students identify and investigate the field to determine the focus of environmental problems.	Observation in the field (outclass)
Problem-solving planning	Students do problem-solving planning.	Discuss (in class)
Creating a project schedule	Students create a project implementation planning schedule.	Discuss questions and answers (in class)
Product Manufacturing	Students make products with the group.	Outclass
Report preparation and presentation of results	Students compile a report on the results of the project.	Outclass
	Students present the product.	In class
Project evaluation	Lecturers and students evaluate project results.	Discuss (in class)
Follow-up	Students perform an actuation of the project results.	Outclass

This research used three instruments: critical thinking, collaboration, and environmental awareness. The critical thinking skills assessment rubric was adopted from Fisher (2013) and Zubaidah et al. (2015). Assessment of critical thinking skills was based on reports or essays from projects undertaken (Nguyen, 2021). The assessment was based on indicators: focus, support reasoning, reason, organization, convention, and integration. The collaboration instrument was based on rubrics and peer questionnaires. The rubric and peer questionnaire indicators were based on indicators: contribution, planning time for completion, efforts to find and share solutions to problems, teamwork, ability to obtain various sources of information, and ability to create formulas and ideas based on information obtained independently and from others.

Furthermore, the environmental awareness instrument used a 27-item questionnaire that included (1) knowledge, (2) attitudes, and (3) skills. The questionnaire was measured using a Likert scale of 1 (strongly disagree) – 4 (strongly agree). Indicators of environmental awareness were knowledge, attitudes, and skills (Farmer et al., 2019; Kim, 2019). All the instruments were declared valid based on product-moment correlation and reliable based on Cronbach's Alpha. The results of the validity of the instrument are presented in Table 2, Table 3, and Table 4. The results of the reliability of the instrument are displayed in Table 5.

Table 2. The Results of the Validity of Critical Thinking Skill Instrument

Item	r Count	r Table	Decision
Focus on the problem	0,875	0.456	valid
Argumentation and supports	0,886	0.456	valid
Event description	0,859	0.456	valid
Flow of thinking	0,889	0.456	valid
Decision and Conclusion	0.821	0.456	valid
Correctness of concept	0,848	0.456	valid

* Significant 0,01.

The Table 3 below is the result of the validity collaboration skill instrument.

Table 3. The Results of the Validity Collaboration Skill Instrument

Item	r Count	r Table	Decision
Share ideas	0,850	0.456	valid
Share knowledge	0,837	0.456	valid
Contribution	0,899	0.456	valid
Accuracy of completion of tasks	0,851	0.456	valid
not be the cause of delays in task completion	0.878	0.456	valid
Effort to find solutions/answers	0,903	0.456	valid
Sharing opinions on problem answers with others	0.823	0.456	valid
Respect for other people's opinions	0,887	0.456	valid
Ability to look at various sources of information	0.807	0.456	valid
Processing information obtained into better ideas	0,808	0.456	valid

* Significant 0,01.

The Table 4 below is the result of the validity of the environmental awareness skill instrument.

Table 4. The Results of the Validity of the Environmental Awareness Skill Instrument

Item	r Count	r Table	Decision
Knowledge of environmental concepts	0,897	0.456	valid
Knowledge of environmental components	0,878	0.456	valid
Knowledge of the relationship between living things in the environment	0,876	0.456	valid
Knowledge of environmental topics from the surrounding environment	0,798	0.456	valid
Knowledge of environmental topics	0,939	0.456	valid
Knowledge of the influence of the environment on human life	0,776	0.456	valid
Knowledge of the influence of the environment on the life of the surrounding environment	0,815	0.456	valid
Knowledge of environmental problems before learning in class	0,890	0.456	valid
Knowledge of environmental pollution	0,865	0.456	valid
Knowledge of environmental problems due to human activities that damage the environment	0,815	0.456	valid
Interest in environmental issues	0,890	0.456	valid
Interest in issues, news, or phenomena related to the environment.	0,865	0.456	valid
Concern for the surrounding environment	0,890	0.456	valid
Experience with feeling uncomfortable seeing a polluted environment	0,865	0.456	valid
Experience with observing the surrounding environment	0,815	0.456	valid
Support for sustainable development efforts to protect the environment	0,814	0.456	valid
Awareness that damaging or polluting the environment is an attitude that is not under existing norms and rules.	0,822	0.456	valid
Students should have concern for the environment.	0,877	0.456	valid
Contribute to protecting the environment	0,890	0.456	valid
Involvement in environmental organization activities.	0,847	0.456	valid
Discussion about environmental conservation in the family	0,792	0.456	valid
Active participation in activities that support the environment.	0,915	0.456	valid
Willingness not to pollute the environment	0,850	0.456	valid
Willingness to act to protect the environment	0,834	0.456	valid
Efforts to protect the environment	0,933	0.456	valid
Willingness to spend time on activities to preserve the environment	0,808	0.456	valid
Willingness to carry out activities to preserve and conserve the environment.	0,774	0,456	valid

Significant 0,01.

While Table 5 shows the results of the reliability.

Table 5. The Results of the Reliability

Instrument	Cronbach's Alpha
Critical thinking	0.935
Collaboration	0.970
Environmental awareness	0.986

Structural Equation Modeling (SEM) analysis was used to determine the effect of the PjBL model on critical thinking skills, collaboration skills, and environmental awareness, as well as critical thinking skills and collaboration skills on environmental awareness. SEM analysis was also used to determine the factor loading of each PjBL indicator and critical thinking skills, collaboration skills, and environmental awareness. The positive or negative effect is seen from the coefficient value. If the coefficient value is >0, the effect is positive; conversely, if the coefficient value is <0. All tests were carried out using SmartPLS v 3.2.9.

RESULTS AND DISCUSSION

Based on preliminary data measuring prospective teachers' environmental awareness level, most are in the medium category. Detailed initial measurement data are shown in Table 6.

Table 6. Categories of Environmental Awareness for Prospective Teachers

Category	Before treatment (%)	After treatment (%)
Low	40,3	9,7
Medium	56,5	46,8
High	3,2	43.5

Table 6 shows the level of awareness before and after the science learning process using the PjBL model for prospective elementary education teachers. Most are in the medium category at 56.5%, while 40.3% of prospective elementary education teachers are in the low category, and only 3.2% are in the high level of awareness. After using the PjBL model, it shows that there is an increase in awareness. 43.5% of prospective teachers are in the high-awareness category, 46.8% are in the medium category, and only 9.7% are in the low-awareness category. After experiencing the use of the PjBL model on environmental material, various data related to the research objectives are obtained, including data on critical thinking skills, collaboration skills, and environmental awareness. The effect of the PjBL model on critical thinking skills, collaboration skills, and environmental awareness, as well as the effect of critical thinking skills and collaboration skills on environmental awareness, are presented in Table 7.

Table 7. The Total Effect of the PjBL Model on Critical Thinking Skills, Collaboration Skills, and Environmental Awareness

	Critical Thinking Skills	Collaboration Skills	Environmental Awareness
Project Based Learning	0.954	0.970	0,962

The PjBL model positively affects prospective elementary education teachers' critical thinking skills, collaboration skills, and environmental awareness. The SEM calculation results show that the factor loading value is ≥ 0.7, as shown in Table 7. Meanwhile, the effects of the PjBL model, critical thinking skills, and collaboration skills on prospective teachers' environmental awareness levels are presented in detail in Table 8.

Table 8. The Results of Path Coefficients of PjBL, Critical Thinking Skills, and Collaboration Skills on Environmental Awareness

	Environmental Awareness
Project Based Learning	0.153
Critical Thinking Skills	0.077
Collaboration Skills	0.766

The data in Table 8 shows that collaboration skills have a higher coefficient than the PJBL model and critical thinking skills. This shows that collaboration skills have a stronger positive effect than the PjBL model and critical thinking skills in increasing the level of awareness of prospective elementary education teachers.

Table 9. The Effect of the PjBL Model, Critical Thinking Skills, and Collaboration Skills on the Level of Awareness of Prospective Teachers

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
PjBL -> Environmental Awareness	0.969	0.969	0.009	104.602	0
PjBL -> Collaboration Skill	0.97	0.97	0.006	153.969	0
PjBL -> Critical Thinking Skill	0.954	0.955	0.009	110.113	0
PjBL -> Collaboration Skill -> Environmental Awareness	0.742	0.738	0.093	7.96	0
PjBL -> Critical Thinking Skill -> Environmental Awareness	0.074	0.072	0.037	1.988	0.047

Table 9 shows the direct effect of the PjBL model on critical thinking skills, collaboration skills, and environmental awareness of prospective teachers. Table 9 also shows the positive effect of critical thinking and collaboration skills on environmental awareness in PjBL learning. This is indicated by a P-value <0.05. This result is supported by the R-square calculation shown in Table 10.

Table 10. The R-Square Calculation Result

	R Square	R Square Adjusted
Critical Thinking Skill	0.910	0.910
Collaboration Skill	0.940	0.940
Environmental Awareness	0.976	0.975

The R-square results show that the inner model or structural model of critical thinking skills, collaboration skills, and environmental awareness is in the strong and substantial category. The structural measurement model is displayed in Figure 1.

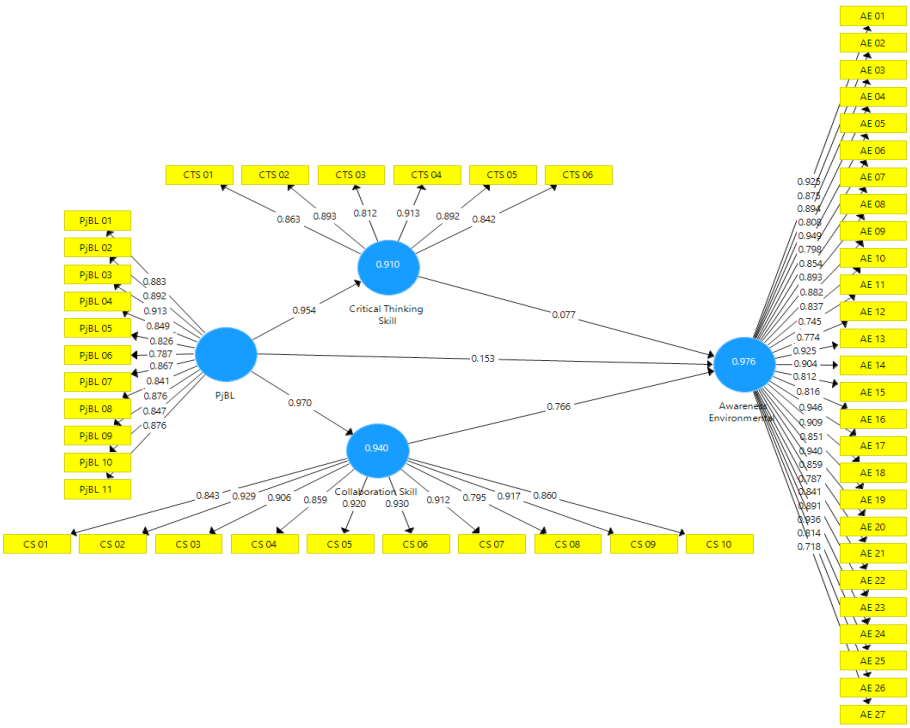

Figure 1. The Structural Equation Measurement Model of PjBL, Critical Thinking Skills, Collaboration skills, and Environmental Awareness

Figure 1 shows that the factor loading values of the indicators from the PjBL model, critical thinking skills, collaboration skills, and environmental awareness are ≥ 0.7. This shows that every indicator of project-based science learning, critical thinking skills, collaboration skills, and environmental awareness is in a significant category. Besides, Figure 1 also shows that the factor loading value of collaboration skills is greater than critical thinking skills.

Research data shows that applied project-based science learning can positively affect critical thinking and collaboration skills. Furthermore, critical thinking and collaboration skills positively affect caring for living creatures and the environment. These results follow previous research. Demssie et al. (2023) discuss increasing environmental awareness through complex problems in the surrounding environment. The results show that the learning approach and real-world environment contribute to improving thinking competence and enable the exchange of diverse ideas among collaborating participants. Projects based on environmental problems will encourage thinking and collaboration skills to increase the awareness of the surrounding environment. In line with research on project-based science learning, participants with high thinking and collaboration skills in learning Living Creatures and the Environment tend to experience increased concern for the environment.

Orhan (2022) views critical thinking skills as a predictor of students' environmental awareness. The results of his research show that critical thinking skills as a predictor have a positive impact on environmental awareness. Meanwhile, Abd-Mutalib (2023) shows that awareness of sharing in collaboration skills can foster concern for the surrounding environment. Orhan (2022) and Abd-Mutalib (2023) are consistent with research on project-based scientific learning, which suggests that environmental awareness can be fostered through critical thinking skills and shared awareness of cooperation skills.

Furthermore, Zahra et al. (2023) discuss the relationship between argumentation and collaboration skills to improve biology learning outcomes. The research results show that argumentation and collaboration skills contribute partly or jointly to improving learning outcomes. Argumentation or reasoning is an indicator of critical thinking skills. Students will try to convey information and knowledge to others through scientific argumentation. These results follow research on project-based science learning, where argumentation is linked as an indicator of critical thinking skills and collaboration skills. This differs from Amin et al. (2022), who examine the effect of hybrid learning based on environmental problems on environmental awareness. The research presents an increase in environmental awareness based on learning without paying attention to other variables. This differs from the research on project-based science learning, which discusses the relationship between variables, namely critical thinking and collaboration on environmental awareness.

Project-based science learning has learning steps that can train prospective teachers to improve their ability to analyze problems, logic, flow of thinking, and find appropriate solutions or conclusions. Focused analysis of environmental problems requires cooperation and sharing knowledge to determine the right solution. The focus of the problem requires a reasonable and logical train of thought to be resolved through the project. Project completion requires cooperation, mutual respect, and sharing ideas and knowledge. The focus of the problem, reasons or arguments, flow of thinking, and appropriate solutions or conclusions are indicators of critical thinking skills. Meanwhile, sharing ideas, thoughts, information, knowledge, and cooperation indicates collaboration skills.

According to Suradika et al. (2023), project-based learning (PjBL) can improve critical thinking skills. Meanwhile, according to Khoiri et al. (2023), the PjBL model can also improve collaboration skills. The increase in both skills caused by the PjBL model has a more substantial effect on environmental awareness. This result is supported by an R-square value ≥ 0.7. The R-square value shows that the structural and measurement model is strong and substantial. The loading factor value for each critical thinking indicator is ≥ 0.7. According to Henseler (2017), if the loading factor value is ≥ 0.7, the indicator used is in the significant category. This shows that each indicator used in research can support improving critical thinking skills in PjBL. Strong support for critical thinking skills can have a positive effect on the level of environmental awareness (Wulansari & Dewi, 2022).

This study's flow of thinking indicator has the highest loading factor value. Prospective teachers with a good line of thinking can develop the ability to think more logically (Arisoy & Aybek, 2021), producing solutions or conclusions to solve problems. A good flow of thinking makes the problems chosen by prospective teachers in the project more focused and urgent to solve. A flow of thinking impacts success in learning

based on a focus on environmental issues (Akbayir & Topçul, 2021) and improves critical thinking skills (Purwanto et al., 2022). The flow of thinking is related to the prospective teacher's skills to describe events logically. Prospective teachers who can describe events systematically and logically, from problems to solutions, have a good flow of thinking. The ability to think and describe events possessed by prospective teachers will be related to the concept of knowledge (Hidayati et al., 2020) and the accuracy of the conclusions or solutions made (Alsaleh, 2020). Understanding the right environmental concepts will provide a stronger understanding of the problems used in the project and the conclusions or solutions chosen (Gokmen, 2016).

The flow of thinking indicators encourages critical thinking skills. This will have an impact on the level of environmental awareness. The increase in the level of awareness of prospective elementary education teachers can be seen from the problems in the surrounding environment used in the project (Aliman et al., 2019; Amin et al., 2022). They try to find the right solution to preserve the environment. The accuracy of solutions to problems is influenced by the flow of thinking (Palavan, 2020), descriptions of events, and arguments or reasons (Meral et al., 2021) based on the knowledge or concepts held. Prospective teachers' efforts to find appropriate solutions to environmental problems in project-based science learning show concern for the surrounding environment.

The research results also show that collaboration skills positively affect the level of environmental awareness of prospective elementary education teachers in project-based science learning. Each indicator of collaboration skills influences this positive effect. Indicators about sharing ideas, information, and knowledge strongly affect collaboration skills in supporting environmental awareness in project-based learning. This indicator is related to indicators regarding contributions to discussions in groups. According to Piumsomboon et al. (2019), the actions and attitudes of sharing and contributing to group discussions increase students' caring attitudes toward the surrounding environment. The desire and intention to share in project-based learning have a positive impact on the growth of a caring attitude that a person has towards others and the surrounding environment (Mustika et al., 2022). Sharing ideas, knowledge, and information in groups causes prospective teachers to process the information obtained better (Savolainen, 2017). Prospective teachers who can take action to share knowledge and information show that they care about each other and the surrounding environment (Ahmad & Karim, 2019). Sharing information and knowledge is a crucial indicator of collaboration skills (Falcione et al., 2019).

Another positive indicator of collaboration skills in project-based learning is mutual respect within and with other groups. The attitudes and actions of prospective teachers, such as respecting each other and listening to other people's opinions, are a form of concern for others (Thompson, 2018). According to Bøhlerengen and Wiium (2022), actions and attitudes of mutual respect show the level of concern a person has. The attitude of mutual respect and contribution to other group members is a form of caring. Improving mutual respect in project-based science learning is essential to support collaboration skills and foster concern for others and the surrounding environment.

Mutual respect for prospective teachers is also shown during group discussions. Group discussions can run well if members respect each other's opinions and ideas when solving problems (Simon & Grabow, 2014). Group discussions are a form of cooperation between members to resolve or solve problems in project-based learning (Splichal et al., 2018; Handayani et al., 2019). Sharing ideas and benefits in group discussions and not being the cause of delays in project completion is an attitude of caring towards shared tasks and responsibilities. Discussions in project-based learning, attitudes, and actions of sharing information and knowledge train caring attitudes and awareness among group members (Zhang et al., 2023) and increase cognitive knowledge (Guo et al., 2020).

Indicators of collaboration skills that strongly affect environmental awareness are mutual respect, sharing knowledge (ideas, thoughts, opinions, information), and cooperation in completing projects. The effect of this indicator can foster concern for others and the surrounding environment (Wang & Liu, 2020; Jung et al., 2021). Collaboration skills have a stronger positive effect on increasing environmental awareness than collaboration skills. This effect is caused by indicators of collaboration skills being stronger in encouraging the formation of environmental awareness. Indicators of collaboration skills place more emphasis on attitudes and actions. Meanwhile, critical thinking skills tend to emphasize cognitive abilities, which are used to support and increase environmental awareness in project-based learning. The application of PjBL to Living Creatures and Their Environment ma-

terial is used to train mutual respect, sharing, and cooperation to increase concern for the surrounding environment.

CONCLUSION

The research results show that critical thinking and collaboration skills positively affect environmental awareness. This is indicated by a P-value for critical thinking skills is 0.047 < 0.05 and a P-value for collaboration skills is 0 < 0.05. Collaboration skills have a stronger effect on environmental awareness in project-based science learning than critical thinking skills (path coefficients = 0.766). Collaboration skills are the main factor in increasing environmental awareness because indicators of collaboration skills emphasize awareness and action to protect the surrounding environment. In contrast, critical thinking skills tend to emphasize the knowledge aspect of how to protect the surrounding environment. The project-based science learning model can be applied in science learning because it is proven to build critical thinking and collaboration skills. The limitation of this study is that it only examines the influence of the variables of critical thinking ability and collaboration ability. Therefore, further research is needed to see the effects of other variables on environmental awareness in project-based science learning, such as creative thinking and communication skills.

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