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The Linkage Between Problem Solving Skills and Social Attitudes with Environmental Literacy of 10th Grade Students at SMAN 7 Malang

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ABSTRACT
The link between problem solving skills (X_1) and social attitudes (X_2) and environmental literacy (Y) is a skill needed by someone to develop attitudes in maintaining a balance between quality of life, environmental quality, and solving environmental problems. This research uses survey research methods. The research design used in this research is a correlational design. The purpose of this study was to determine the linkage between X_1 and X_2 with Y of 10th grade students at SMAN 7 Malang. This research was conducted at SMAN 7 Malang with 33 respondents from 10th grade students. The analysis of research data using Pearson correlation with a significance value of 0.05. The results of the study obtained an average value of X_1 of 55.87, X_2 of 79.35, and Y of 69.05. The correlation value of the significance level of X_1Y, X_2Y, X_1X_2, X_1X_2Y is 0.008; 0.951; 0.510; 0.028. The correlation coefficient values of X_1Y, X_2Y, X_1X_2, X_1X_2Y are respectively 0.461; -0.045; -0.119; 0.461. Analysis of the contribution path from X_1 provides an effective contribution of 21.34%, X_2 provides an effective contribution of -0.045%, while X_1X_2Y together makes an effective contribution of 21.29%. There is a contribution of 78.71% from other factors (Z). The relationship pattern, suggest that the biggest effective contribution to Y is X_1, while X_2 must be together with X_1 to affect Y effectively.

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1. INTRODUCTION

The human population, which continues to increase from year to year, cannot be separated from the environment as space occupied by living things, including other non-living things (Hidayati et al., 2020). An increase in the human population that is not matched by environmental awareness is one of the causes of environmental problems (Aliman et al., 2019). The continuously increasing rate of settlement growth, environmental pollution, deforestation, and decreased biodiversity are environmental problems that occur due to low environmental awareness (Sukma et al., 2020). Environmental problems should be prevented and resolved immediately so as not to cause other environmental problems (Ichsan et al., 2020).

Environmental problems can be overcome by cultivating environmental awareness through implementing a good environmental education system (Reid et al., 2021). Environmental education has a fundamental role in forming students' character so that they always have sensitivity and awareness of the surrounding natural environment (Amrullah & Nurcahyo, 2021). Environmental education can help students rethink the relationship between humans and the environment, starting from understanding their environment, being aware of environmental problems and considering environmental issues related to their lives (Ramadhan et al., 2019). Environmental education contributes to forming students' habits in thinking and solving environmental problems around them (Nuraeni et al., 2020). Problem solving skills are skills that students need to master in minimizing and overcoming environmental problems (Sigit et al., 2021).

Solving environmental problems needs to be supported by a good attitude. One of the aims of implementing environmental education is to forming students' attitudes towards the environment and living things around it (Marcinkowski & Reid, 2019). Students' attitudes in learning are considered important because it can affect students' performance and can improve students' learning achievement (Kurniawan et al., 2019). The attitude

required by students in learning is social attitude. Students with good social attitudes will be able to establish good cooperation to achieve learning goals, good response to social objects and also the natural environment (Bustami et al., 2017). Students who have a good response to the environment will lead to responsible actions towards the environment, so that students who have this attitude will have good environmental literacy (Kholifaturrohmah et al., 2023).

Environmental literacy is very important to be instilled in students with the aim of being able to overcome environmental problems and be able to maintain the preservation of the earth (Aprilianti & Suratsih, 2023). Environmental literacy can empower individuals to make wise decisions and take important actions for society responsibly by considering their relationship with the environment and implementing a lifestyle based on the principles of sustainable environmental management (Goulgouti et al., 2019). Empowerment of environmental literacy can be carried out in science learning, especially in the Adiwiyata program and biology subjects (Pangestu et al., 2023). The Adiwiyata program aims to create schools that care and have an environmental culture, its implementation is based on three principles, namely educative, participatory and sustainable. The implementation of the Adiwiyata program has a positive influence in fostering students' environmental literacy in terms of maintaining the cleanliness of the classroom and school environment (Caddafie et al., 2017).

A preliminary study that was conducted at SMAN 7 Malang, found that the school had implemented the Adiwiyata program as a means for developing students' environmental literacy. Environmental literacy is also trained by biology teachers in classroom learning by presenting real problems in the environment around students to be solved and solutions sought, so that students can develop problem solving skills and environmental literacy. Efforts to develop problem solving skills, social attitudes, and literacy environment that has been carried out by the teacher needs to be studied more deeply to find out the relationship between one skill and another.

Based on the background that has been explained, the aims of this study are: (1) to analyze problem solving skills, (2) to analyze social attitudes, (3) to analyze the environmental literacy, (4) analyze the linkage through problem solving skills and environmental literacy, (5) analyze the linkage through social attitudes and environmental literacy, and (6) analyze the linkage between problem solving skills and social attitudes with environmental literacy of 10^{th} grade student at SMAN 7 Malang simultaneously.

2. RESEARCH METHOD

Research method applied in this research was survey research method. This research was carried out by collecting information through giving questionnaires to students to describe the behaviour, opinions, attitudes, or experiences of the research subjects (Leedy & Ormrod, 2021). This study consisted of three variables, namely problem-solving skills as the independent variable (X_1) and social attitudes as the independent variable (X_2) towards environmental literacy as the dependent variable (Y). Hypothesis testing in this research uses a correlational design to determine the linkage between research variables. This research was conducted in March 2023 at SMAN 7 Malang which is located at Jl. Cengger Ayam I No.14, Kel. Tulusrejo, Kec. Lowokwaru, Malang City, East Java. The respondents in this study included 33 students of 10^{th} grade of SMAN 7 Malang for the 2022/2023 academic year. The technique used in selecting the sample is purposive random sampling technique.

The instrument for collecting data used in the variable problem-solving skills was a test in the form totalling 8 essay questions that are integrated with indicators of problem-solving skills from Greenstein (2012). The instrument for collecting data on students' social attitudes uses a questionnaire students' social attitudes adapted from Baidhowi (2018). Data collection on environmental literacy variables used research instruments in the form of tests and questionnaires with a Likert Scale adopted by the Middle School Environmental Literacy Survey (MSELS). The environmental literacy instrument on the aspect of ecological knowledge is in the form of multiple-choice questions totalling 30 questions. Three other aspects of environmental literacy contained in this research consist of cognitive skills, environmental attitudes and environmental behaviour measured using a Likert Scale questionnaire with a total of 20 positive statements and 20 negative statements. Before the research instrument is used for data collection, a validity and reliability test of the instrument is carried out first. Research data must go through prerequisite tests, namely the normality test and homogeneity test. Next, to determine the correlation between variables, the data was analyzed using regression tests and correlation tests.

Table 1. Variable Value Category

Value Range	Category
90-100	Very good
80-89	Good
65-79	Moderate
55-64	Low
0-54	Very Low

Source: (Cahaya *et al*., 2018:15)

3. RESULT AND DISCUSSION

Problem solving skills are the basic process of identifying problems, considering solutions, and making choice of solutions based on problems (Rahman, 2019). Problem solving skills consist of 8 indicators, namely: 1) Identifies the problems; 2) Applies of problem-solving steps; 3) Identifies solutions; 4) Evaluate solutions; 5) Defends solutions; 6) Real world applications; 7) Inductive reasoning; and 8) Deductive reasoning (Greenstein, 2012). The results of measuring each indicator of problem-solving skills using a description form test are shown in Table 1.

Table 1. Average Value of Problem-Solving Skills Each Indicators

Indicator	Value	Category
Identifies the Problem	71,97	Moderate
Applies Problem Solving Steps	59,85	Low
Identifies Solutions	78,79	Moderate
Evaluate Solutions	47,73	Very Low
Defends Solutions	59,09	Low
Real World Applications	40,91	Very Low
Inductive Reasoning	43,18	Very Low
Deductive Reasoning	45,45	Very Low
Average	**55,87**	**Low**

Based on Table 1. It can be known that students' problem-solving skills on the indicator identifies the problem get an average value 71.97 in the moderate category. Indicator applies problem solving steps get an average value 59.85 in the low category. The average value of indicator identifies solution is 78.79 in the moderate category. The average value of indicators evaluate solutions is 47.73 in the very low category. The average value on the indicator defends solutions is 59.09 in the low category. The average value of indicator real-world applications is 40.91 in the very low category. The average value on the indicator inductive reasoning is 43.18 in the very low category. The average value of indicator deductive reasoning is 45.45 in the very low category. All indicators of problem-solving skills get an average value 55.87 in the low category because students have not been able to master the formulation of the problem. Efforts to develop students' problem-solving skills can be done by implementing a problem-based learning model because this learning model can train students to actively think, analyze, receive information, process data, and finally draw conclusions (Cahaya et al., 2018).

The problem-solving abilities of SMAN 7 Malang students require efforts to train and improve them in order to create quality human resources. Problem-solving abilities are very important for individuals to master well because in dealing with new problems it means that we cannot use the paths, experiences, or methods that were previously given to find solutions (Daryanes et al., 2023; Olivares et al., 2021). Students' mastery of a concept or learning content is very important in the implementation of a learning process. The most basic thing that educators often use to determine the results of learning achievement is students' ability to understand and master a concept as a whole. Students' ability to understand and master concepts greatly influences the smoothness of the learning process (Azrai et al., 2017).

Attitude is an important thing to develop because attitude greatly influences a person's behaviour. The emergence of certain actions or behaviours in a person is due to social attitudes (Rodiyah et al., 2018). Social attitudes are attitudes that concern social life as a form of student interaction with nature, the school environment and the surrounding environment (Gusviani, 2016). Social attitudes have 7 indicators, namely: 1) Honesty; 2) Discipline; 3) Responsibility; 4) Tolerance; 5) Mutual cooperation; 6) Politeness; and 7) Self-confident (Direktorat Pembinaan SMA, 2017). The results of measuring each social attitude indicator obtained from the distribution of student social attitude questionnaires are presented in Table 2.

Table 2. Average Value of Social Attitudes Each Indicators

Indicator	Value	Category
Honesty	80,00	Good
Discipline	77,17	Good
Responsibility	82,83	Good
Tolerance	76,87	Good
Mutual Cooperation	77,93	Good
Politeness	81,11	Good
Self-confident	78,70	Good
Average	**79,35**	**Good**

Based on Table 2. It can be known that the level of students' social attitudes on the indicator honesty obtained an average value of 80 belonging to the good category. The average value of indicator discipline is 77.17 belonging to the good category. The average score of indicator responsibility is 82.83 belonging to the good

category. The average value on the indicator tolerance is 76.87 belonging to the good category. The average value of indicator mutual cooperation is 77.93 in the good category. The average value of indicator politeness is 81.11 belonging to the good category. The average value of indicator self-confidence is 78.70 in the good category.

Social attitudes are very important for students because they will be able to interact well with teachers and peers in an acceptable way (Qondias et al., 2022). Instilling social attitudes will shape students to become better individuals and are useful as provisions for entering society in the future (Utami et al., 2019). The development of students' social attitudes can be known by assessing social attitudes. The characteristics of students' social attitudes that have developed are that students are able to appreciate, appreciate and behave honestly, disciplined, responsible, caring (tolerance, mutual cooperation), polite, confident, and can interact effectively with the social and natural environment. The application of students' social attitudes is very important in the learning process because it can help students as an effort to build a new superior culture in learning to achieve learning success (Santyasa et al., 2019).

Environmental literacy is an individual's ability to maintain environmental balance including knowledge of the environment, responsibility for the environment, and being able to provide solutions to environmental problems. Environmental literacy consists of 4 aspects, namely: 1) environmental knowledge, including basic environmental knowledge; 2) attitudes towards the environment, including sensitivity and feelings towards the environment; 3) cognitive skills, including identification, analysis, and planning implementation of environmental problems; and 4) behavior or concrete actions towards the environment (McBeth et al., 2011). Environmental literacy is a key concept in promoting individual attitudes towards conscious lifestyle changes to environmental challenges in a sustainable manner (Bissinger & Bogner, 2018). The measurement results of each environmental literacy indicator obtained by completing a student environmental literacy questionnaire and multiple-choice student literacy tests are presented in Table 3.

Table 3. Average Value of Environmental Literacy Each Aspects

Aspects	**Value**	**Category**
Ecological Knowledge	76,67	Moderate
Cognitive Skills	65,45	Moderate
Pro-Environment Behavior	68,22	Moderate
Attitudes Towards the Environment	65,88	Moderate
Average	**69,05**	**Moderate**

Based on Table 3. It is known that the environmental literacy level of students in the aspect of ecological knowledge obtained a value of 76.67 belonging to the moderate category. Aspects of cognitive skills obtain a value of 65.45 belonging to the moderate category. Aspects of environmental attitudes obtained a value of 68.22 belonging to the moderate category, and aspects of behaviour towards the environment obtained a value of 65.88 belonging to the moderate category.

Environmental literacy is one of the main competencies needed by students to overcome environmental problems (Waqidah et al., 2020). Environmental literacy applied in formal education like schools aims to create a generation that is aware and cares about the environment (Hollweg et al., 2011). This environmental literacy learned in formal education will serve as an accurate measurement tool to fight the crisis from the environment itself (Almeida & Vasconcelos, 2013). Students' environmental literacy is still considered low due to several factors, one of the contributing factors is the lack of intention to know and study environmental problems (Afrianda et al., 2019). Another factor is the low environmental literacy of students, namely because learning only focuses on teaching environmental knowledge does not fully achieve the goals of environmental education (Liang et al., 2018).

Several skills needed to empowered in the 21st century to help improve understanding of the material and develop superior personal characteristics including problem solving skills, social attitudes, and environmental literacy. Figure 1 shows the results of differences average value for problem solving skills, social attitudes, and environmental literacy of 10th grade students SMAN 7 Malang.

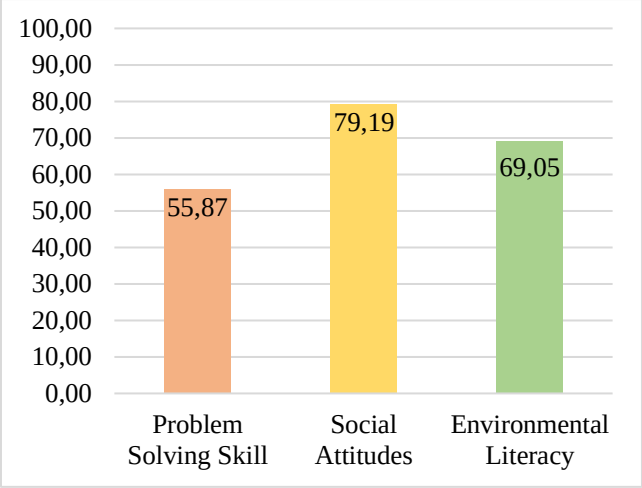

Figure 1. Graph of The Differences Average Value of Problem-Solving Skills, Social Attitudes, and Environmental Literacy

Based on Figure 1. It is known that the average value of students' problem-solving skills, social attitudes, and environmental literacy are respectively 55.87; 79.19; 69.05. So, it can be seen that the criteria of social attitudes and environmental literacy belonging to the moderate category while problem solving skills are belonging to the low category. The linkages between problem solving skills, social attitudes, and environmental literacy can be seen in Table 4.

Table 4. Value of Linkages Problem Solving Skills, Social Attitudes, and Environmental Literacy

Correlation	**Significance Level**	**Correlation Coefficient Value**	**Relative Contribution**	**Effective Contribution**
X_1Y	0,008	0,461	100,2%	21,34%
X_2Y	0,951	-0,045	-0,2%	-0,045%
X_1X_2	0,510	-0,119	0%	0%
X_1X_2Y	0,028	0,461	100%	21,29%

Information:
X_1 Y: Problem Solving Skill; X_2: Social Attitudes; Y: Environmental Literacy; Z: Another Factor

Based on Table 4, it can be seen that the X_1Y data has a significance value of 0.008, this value is smaller than 0.05. This value shows that the research hypothesis (H1) is accepted, this means that there is a relationship between X_1 and Y with an effective contribution value of X_1 of 21.34% to Y. This value shows that the research hypothesis (H1) cannot be accepted, which means there is no relationship between X_2 and Y. The effective contribution value of X_2 to Y has a very small value of -0.045%. Data X_1X_2 has a significance value of 0.510, this value is greater than 0.05. This value shows that the research hypothesis (H1) is rejected, which means that there is no relationship between X_1 and X_2. This is reinforced by the effective contribution value of X_1 to X_2 of 0%. The X_1X_2Y data has a significance value of 0.028, this value is smaller than 0.05. This value shows that the research hypothesis (H1) is accepted, which means that there is a relationship between X_1, X_2 and Y. This is reinforced by the data that X_1 through X_2 to Y has an effective contribution of 21.29%. An illustration of the relationship between X_1, X_2, and Y can be seen in Figure 2 and Figure 3.

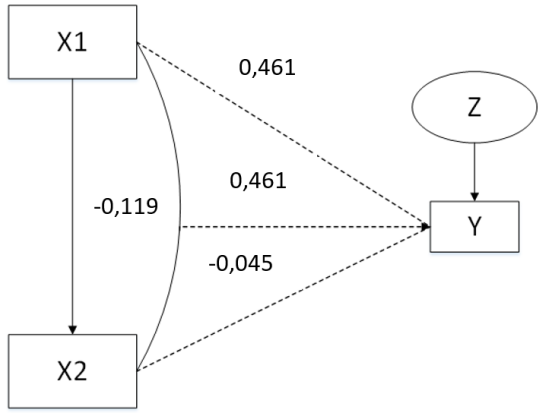

Figure 2. Value of The Relationship Between X_1, X_2, and Y

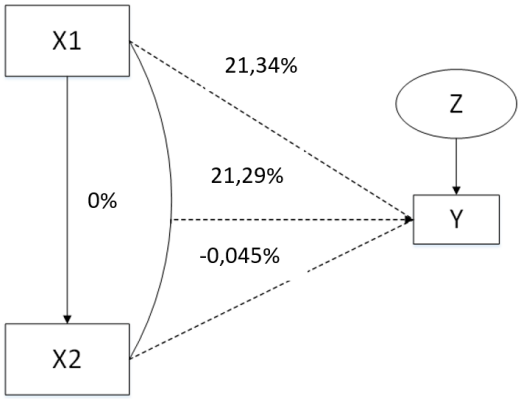

Figure 3. Effective Contributions Between X_1, X_2, and Y

Information: X_1: Problem Solving Skill; X_2: Social Attitudes; Y: Environmental Literacy; Z: Another Factor

Based on Figure 2, the correlation coefficient value of problem-solving skills on environmental literacy is 0.461. Social attitudes towards environmental literacy are -0.045. Problem solving skills on social attitudes are -0.119. Problem solving skills and social attitudes jointly affect environmental literacy, namely the correlation coefficient is 0.461. Based on the interval value, it is known that the relationship between problem-solving skills and environmental literacy is moderate, the relationship between social attitudes and environmental literacy is very low, problem-solving skills and social attitudes are classified as very low, while problem-solving skills and social attitudes together with environmental literacy are moderate, therefore it can be said that there is a relationship between problem solving skills, social attitudes, and environmental literacy.

Based on Figure 3, there is a large difference in the effective contribution made by problem solving skills to environmental literacy and social attitudes towards environmental literacy. The biggest contribution that affects environmental literacy is the contribution of problem-solving skills which makes an effective contribution of 21.34%, while social attitudes make an effective contribution of -0.045%. If reviewed together, problem solving skills and social attitudes make an effective contribution of 21.29%. There is a contribution of 78.71% from another factors (Z).

The results of the hypothesis test for the link between problem-solving skills and environmental literacy in Table 4 show a significance value for data X_1Y less than 0.05 (0.008 <0.05) indicating that the research hypothesis (H1 is accepted), while the correlation coefficient value is 0.461 which includes moderate category. Based on path analysis, the value of the effective contribution of problem-solving skills to environmental literacy is 21.34%. Based on research facts, the implementation of the Adiwiyata program is an effort by teachers to train problem solving and environmental literacy skills of grade 10 students at SMAN 7 Malang. In implementing the Adiwiyata Program, students are actively involved in efforts to preserve the environment and students are helped in developing and applying knowledge about the environment as a way to find solutions to solve environmental problems through the Adiwiyata program (Kamil et al., 2021). Environmental literacy goes together with academic abilities to help students in the process of understanding environmental problems so that students will be helped in formulating appropriate solutions so that they have an influence in improving environmental problem-solving skills (Alkair et al., 2023).

Table 4 presents a significance value from hypothesis test of linkage between social attitudes (X_2) and environmental literacy (Y), X_2Y gets the significance value more than 0.05 (0.951> 0.05) indicating that the research hypothesis (H0 is rejected), while the correlation coefficient value is -0.045 which includes very low category. Based on path analysis, the contribution value of technological literacy to collaboration skills is -0.045%. Based on the research facts of 10th grade students of SMAN 7 Malang that teachers always carry out assessments of social attitudes that are integrated with appropriate learning. The teacher said that it was less intensive in developing students' social attitudes by the teacher by adjusting aspects of social attitudes to the material and learning activities carried out. Attitude formation is impacted by several factors such as personal experience, culture, other people who are around them, social media, personal emotional factors, academic and religious institutions (Utami et al., 2019).

The results of testing the hypothesis of the link between problem solving skills and social attitudes in Table 4 the significance value of the data X_1X_2 is more than 0.05 (0.510> 0.05) indicating that the research hypothesis (H0 is rejected), while the correlation coefficient value is -0.119 which included very low category. Based on the

path analysis that the value of the effective contribution of problem-solving skills to social attitudes is 0%. Based on research facts from 10th grade students of SMAN 7 Malang that during biology lessons, teachers always apply problem-based learning (PBL) which raises real problems in the environment around students.

The problem-based learning model applied by the teacher can develop students' problem-solving skills. Problem-solving skills that students acquire through learning will provide concrete and meaningful experiences that make students accustomed to dealing with real problems in their surroundings (Abdillah et al., 2021). The PBL learning model involves students in group discussion activities, this will guide students to have better interactions between students and other students so that they can form students' social attitudes (Bialangi et al., 2016).

The results of testing the hypothesis of the relationship between problem solving skills and social attitudes with environmental literacy in Table 4 the significance value of the data X_1X_2Y is less than 0.05 (0.028 <0.05) indicating that the research hypothesis (H1 is accepted), while the correlation coefficient value is 0.461 which included to moderate category. Based on the path analysis, it is known that the value of problem-solving skills which makes an effective contribution is 21.34%, while social attitudes make an effective contribution of -0.045%. The effective contribution of problem-solving skills and social attitudes together to environmental literacy is 21.9%, there is an influence from the ε factor (other factors).

The contribution of social attitudes is less when compared to the value of the contribution of problem-solving skills. Social attitudes can be more effective in influencing environmental literacy, if applied together with problem solving skills. This means that problem-solving skills and social attitudes are skills that are interconnected in shaping students' environmental literacy (Afrianda et al., 2019; Kholifaturrohmah et al., 2023).

Problem solving skills involve attitudes to articulate social knowledge, articulate personal strategies, and articulate prejudices/cognitive weaknesses (Rahma et al., 2020). Social attitudes will guide students to make better interactions between students and the social objects around them, so that the outcomes of the learning process are not only students who have knowledge and skill competencies, but are also expected to have good attitudes (Bialangi et al., 2016). If students master social attitudes well, they will respond well to social life and the surrounding environment. This can also allow students to develop good environmental insight (Kholifaturrohmah et al., 2023). Students' mastery of environmental insight will help them become someone who is competent towards the environment, has consistency in maintaining a balance between the quality of life and the quality of the environment (Kaya & Elster, 2019).

Someone who has an environmental perspective, maintaining balance, restoring or improving environmental quality for sustainable environmental sustainability is a form of embodiment of someone who has environmental literacy (Waqidah et al., 2020). Environmental literacy is one of the skills needed to empower individuals so that they can wisely make decisions, take responsibility for every decision they have taken, reconsider their relationship with the surrounding environment and implement a lifestyle based on the principles of sustainable environmental management (Goulgouti et al., 2019). Environmental literacy is important for students as an effort to be environmentally literate, where they not only have knowledge about the environment but also have a responsive attitude, good behavior (Kusumaningrum, 2018) are able to deal with environmental problems by providing solutions to environmental problems so that the environment is maintained in its condition and sustainability (Prasetiyo et al., 2020).

4. CONCLUSION

The conclusions that can be obtained based on the results of this research, the hypothesis testing of the link between problem solving skills and social attitudes with environmental literacy has the significance value less than 0.05 (0.028 <0.05) indicating that the research hypothesis (H1 is accepted), while the coefficient value correlation value of 0.461 which includes the moderate category. The effective contribution of problem-solving skills and social attitudes together to environmental literacy is 21.9%, there is an influence from the ε factor (other factors).

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