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# Correlation between learning style, gender, and university location toward environmental problem-solving skills

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**ABSTRACT**

Environmental degradation in technological development is accelerating. Therefore, it requires environmental problem-solving skills. This study is aimed to determine university students' learning style and skill to solve environmental problems based on gender and university location. In addition, this study also aims to find the correlation between learning styles, gender, and university location towards environmental problem-solving skills. The population of this study was the university student in Indonesia. This study employed a descriptive and correlational study. The researchers used the VARK test to find out the learning style. Meanwhile, the data on the environmental problem-solving skills collected by using a validated and tried out test instrument that refers to indicators from Ridhwan. The results of this study showed that the students' learning styles tended to be visual at 50.49%. The environmental problem-solving skill was in the low category with an average score of 41.47. There was no any correlation between learning styles and gender with the ability to solve environmental problems, but in variable of university location, there was a significant correlation. This is because university differences are closely related to location differences and have an impact on access to learning facilities.



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## 1. INTRODUCTION

Environmental problems are negative aspects of human activities on the environment. The low level of people's knowledge and awareness triggers environmental damage. Considering this condition, the skill to solve environmental problems is an important competency that students must have, especially in geography learning. Problem-solving in geography learning functions to deal with situations in the real world [1]–[3]. Problem-solving skills are also a demand in the Indonesian curriculum. Moreover, these skills are included in cognitive aspects in the domain of high-level thinking [4], [5]. Therefore, geography learning to develop problem-solving skills emphasizes the activity of finding solutions to each problem.

The problems being solved in the geography learning process are closely related to the problems of everyday life [6]–[8]. These problems are contextual problems related to problems that exist in the environment [9]. Environmental aspects also become the main theme of 21st-century learning. The mastery of the skill to solve environmental problems becomes an important factor so that it needs to be applied in learning. Problem-solving requires systematic learning steps. These steps are different from just answering questions [10]. The steps in problem-solving begin with recognizing the problem carefully [11]. Problems

that can be recognized by students are easier to find the cause, so they can find alternative solutions. The next step is to choose and determine alternative solutions. Determination of alternative solutions is based on empirical data and facts, so that the chosen alternative solutions can be implemented and accounted for students.

Previous studies showed that problem-solving skills have become the focus of studies in various fields. Problem-solving skills that have been studied are in the field of programming [12], biology [13], physics [14], mathematics [15], [16], English [17]–[19], and accounting [20]. Therefore, the ability to solve environmental problems is interesting and needed to study.

Environmental problem-solving skill is one of the results of learning. This skill depends on various factors, one of which is learning style. Through the learning style, the teacher can see the strengths and weaknesses of students [21]–[23] so that the teacher can choose the right teaching method. This study used the 1992 Fleming learning style test in which the test divided the learning styles into four categories, namely visual, auditory, reading, and kinesthetic. The selection of the test is based on conformity with the student learning environment [24].

Previous studies that have been done aimed to identify differences in problem-solving skills based on the educational level, gender, and age. Nevertheless, a study with the theme of solving environmental problems in geography learning by involving learning styles, gender, and location of university simultaneously has not been done much. In more detail, this study answers the following research questions:

i) How is the student's learning style when viewed from gender and university location?
ii) How is the ability to solve environmental problems when viewed from gender and university location?
iii) Does the difference in learning styles have a significant correlation with environmental problem-solving skill?
iv) Do gender differences have a significant correlation with environmental problem-solving skill?
v) Do university location differences have a significant correlation with environmental problem-solving skill?
vi) Do learning styles, gender, and university location differences have a significant influence on environmental problem-solving skill?

Based on the research question, the main research objective is to determine the correlation between learning style, gender, and university location and the ability to solve environmental problems. To answer the core question, another research objective is to determine learning style tendencies in terms of gender and university location, environmental problem-solving abilities in terms of gender and university location. Researchers also want to see the correlation between differences in learning styles and environmental problem-solving abilities, the correlation between gender differences and learning styles, as well as the correlation between university location and environmental problem-solving abilities.

Practical and theoretical contributions are expected from this study. We present research implications in the discussion and conclusions section of the research results. Thus, this research can be a basis for determining learning directions and important input so that geography learning can develop environmental problem-solving skills.

## 2. METHOD

This study is a correlational study. It aims to find the relationship between learning styles, gender, and university location towards environmental problem-solving skill. This study used quantitative data. The use of quantitative data has several advantages, namely that it is suitable for scientific data analysis and makes it easier to draw general conclusions [25]. The data was obtained from learning style questionnaires and problem-solving skill tests.

This study involved university student in Indonesia. The study sample involved 206 students taken from three university. A total of 115 men and 91 women from three universities were involved in the research. These university are taken based on three different locations. University A is located in the city center, University B is located in a densely populated residential area, and University C is located in rural areas. There were 2 classes at each university which at the time the research was carried out were taking Environmental Geography courses. The number of participants at University A was 69 students, University B was 67 students, and University C was 70 students.

The collected data was in the form of quantitative data. The quantitative data was in the form of learning style test results using learning style Visual Auditory Reading Kinestetic (VARK) instruments and the results of the environmental problem-solving skill test. The VARK questionnaire has been widely used by researchers who want to know learning styles [26]–[28]. More specifically, the learning style test consists of sixteen multiple choice questions. Using multiple choices makes it easier for participants to be involved in research and facilitates data collection and analysis [29]. Meanwhile, the problem-solving skill test consists

of ten description questions that are connected with the problem-solving indicators from Ridhwan *et al*. [3]. Several modifications are required in the development of the test instrument to suit the intended subject. The indicators and questions can be seen in Table 1.

The instrument was tested on 30 students from Universities A, B, and C who had taken environmental geography lectures. The aim of the trial is to determine the validity and reliability of the instrument. This aims to ensure that the instrument is appropriate for assessing participants' environmental problem-solving abilities. Validity aims to assess truth, while reliability aims to assess the accuracy and accuracy of measuring instruments [30]. The results show that 10 questions have valid values with a range of 0.527-0.780. Furthermore, the instrument developed was reliable with a Cronbach's alpha value greater than the r table (0.876>0.361).

This problem-solving skill test was carried out for 2x50 minutes. The score for each item was adjusted to the difficulty level of the question. If students were able to answer all questions perfectly, then the value obtained by students was 100. The learning style test was analyzed by grouping student choices based on the learning style options (visual, auditory, reading, and kinesthetic). To answer the correlation between differences in learning styles, gender, and university location, Spearman correlation analysis was used. Whereas to answer questions about the influence of learning styles, gender, and university location, the researchers used multiple regression analysis. All these data analyses were fully assisted with SPSS 25 for Windows software.

Table 1. Indicators and questions for solving environmental problems

| No. | Indicator | Questions number | Question | Score |
|---|---|---|---|---|
| 1. | Formulating problems | 1 | What are the problems that are found in the text? | 5 |
| 2. | Formulating hypothesis | 2 | What are the factors that cause these problems? | 5 |
| | | 3 | What will happen if the problems are not addressed immediately? | 5 |
| | | 4 | What is the solution to dealing with problems in the text? | 10 |
| 3. | Collecting data | 5 | Are there any difficulties that will be encountered to deal with problems? | 10 |
| 4. | Testing the hypothesis | 6 | What is the best solution to overcome these problems? | 10 |
| | | 7 | What are the advantages and disadvantages of the given solution? | 10 |
| | | 8 | Based on your choice, how is the practical way to solve these problems? | 15 |
| 5. | Providing problem-solving recommendation | 9 | If the given solution experiences constraints, are there any alternative solutions to overcome these problems? | 15 |
| | | 10 | How are the alternative solutions to solve the problems? | 15 |

Modification from Ridhwan *et al*. [3]

## 3. RESULTS AND DISCUSSION

### 3.1. Results

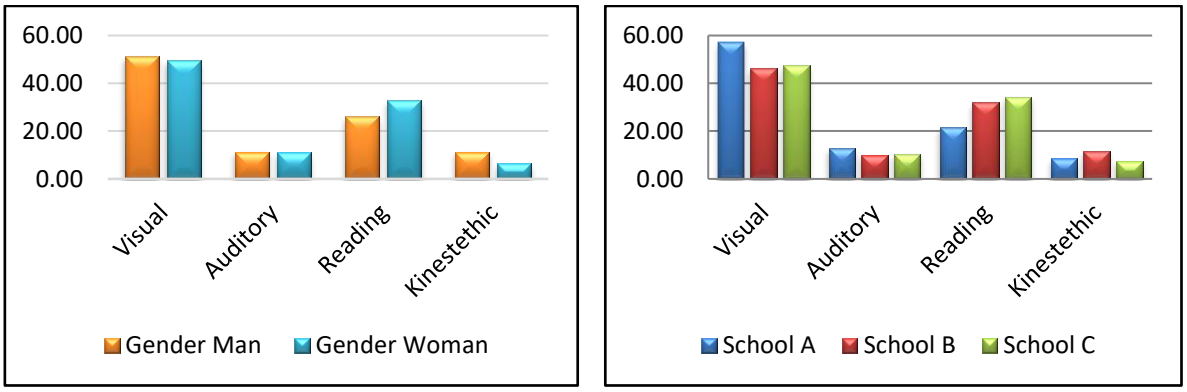
#### 3.1.1. Description of the learning styles viewed from gender and university differences

The first research question is a description of learning styles in terms of gender and university differences. In Table 2, it explains that learning styles consist of visual, auditory, reading, and kinesthetic without looking at differences in gender and university. The percentage numbers are presented in Table 2.

It can be seen in Table 2 that the percentage of the student learning style. It can be seen in gender difference and university location difference. For details of the percentage of learning styles based on gender is can be seen in Figure 1 (a), and details of the percentage of learning styles based on university location is shown in Figure 1 (b). The research results show that there are several differences in learning styles from gender differences. Figure 1 shows that men are superior in visual, auditory and kinesthetic learning styles. Meanwhile, the style of learning to read is dominated by women. University A has advantages in visual and auditory learning styles. Then, University B is superior in kinesthetic learning style and University C is superior in reading learning style.

Table 2. Categories of student learning styles based on gender and university differences

| Learning style | Percentage | Gender | | University | | |
|---|---|---|---|---|---|---|
| | | Men | Women | A | B | C |
| Visual | 50.49 | 51.30 | 49.45 | 57.14 | 46.38 | 47.76 |
| Auditory | 11.17 | 11.30 | 10.99 | 12.86 | 10.14 | 10.45 |
| Reading | 29.13 | 26.09 | 32.97 | 21.43 | 31.88 | 34.33 |
| Kinesthetic | 9.22 | 11.30 | 6.59 | 8.57 | 11.59 | 7.46 |




(a) (b)

Figure 1. Student learning styles based on (a) gender and (b) university differences

### 3.1.2. The statistical description of the environmental problem-solving skills in terms of gender and university differences

This study aims to analyze the environmental problem-solving skills that students have on geography subject. Before the question was given, the students were first asked to read articles about environmental damage due to gold mining [31]. The test results were analyzed using descriptive statistical calculations. Students' problem-solving skill is in the low category with an average score of 41.47. The highest score of students in environmental problem-solving skill was 75 while the lowest score was 20. In addition, the percentage of problem-solving skill for each indicator can be seen in Table 3.

Table 3. Description of the statistical environmental problem-solving skills in gender

| Indicator | Gender | Mean | Std. Deviation | Std. Error mean |
|---|---|---|---|---|
| Environmental problem-solving skills | Men | 40.96 | 10.580 | 0.987 |
| | Women | 42.11 | 11.345 | 1.189 |

It is seen in Table 3 that the average value of the environmental problem-solving skills in men was 40.96 and women was 42.11. This shows that women were superior to men in the skill to solve environmental problems of 1.15. Furthermore, the problem-solving skill based on university differences is can be seen in Table 4.

Based on the table, the results show that there are differences in problem solving skills. University A has average environmental problem-solving skills score of 47.23 and University B 39.72 while University C is 37.24. It can be concluded that University A is superior to Universities B and C in its ability to solve environmental problems.

Table 4. Statistical description of the environmental problem-solving skills in university

| Indicator | University | Mean | Std. Deviation | Std. Error mean |
|---|---|---|---|---|
| Environmental problem-solving skills | A | 47.23 | 11.624 | 1.389 |
| | B | 39.72 | 9.423 | 1.134 |
| | C | 37.24 | 8.978 | 1.097 |

### 3.1.3. The correlation between learning styles and the environmental problem-solving skills

The research answers the third question, namely the correlation between learning styles and environmental problem-solving skills. The analysis uses Spearman's rho correlation. The complete information can be seen in Table 5.

Based on the table, it is known that the number of correlation coefficients was -0.036. This means the level of strength (correlation) between learning styles with the problem-solving skill of -0.036 or very weak. The correlation number was negative so the correlation was not in the same direction. Furthermore, the significance value (2-tailed) was 0.609 or greater than 0.05. Then, it can be interpreted that there was no correlation between learning styles and problem-solving skill.

Table 5. Correlation between learning styles and the environmental problem-solving skills

| Statistical method | Indicator | Statistical measure | Value |
|---|---|---|---|
| Spearman's rho | Environmental problem-solving skills | Correlation coefficient | -0.036 |
| | | Sig. (2-tailed) | 0.609 |
| | | N | 206 |

### 3.1.4. Correlation between gender and environmental problem-solving skills

The fourth research problem is regarding the correlation of gender with solving environmental problems. Although several studies have analyzed the presence and absence of the influence of gender on problem-solving abilities, research is interested in exploring it in students. Analysis using Spearman's rho correlation. The detail information is can be seen in Table 6. Based on the table, it is known that the correlation coefficient between gender variables and problem-solving was equal to 0.043. This means that the level of strength of the correlation between gender variables with problem-solving skill was 0.043 or very weak. The direction of correlation shows a positive direction, so it can be interpreted that the correlation between gender variables and problem-solving abilities was in the same direction. Furthermore, the significance value (2-tailed) was 0.540>0.05 so that it can be interpreted that between the gender variables and the problem-solving skill variables there was no significant correlation.

Table 6. Gender relations with environmental problem-solving skills

| Statistical method | Indicator | Statistical measure | Value |
|---|---|---|---|
| Spearman's rho | Environmental problem-solving skills | Correlation coefficient | 0.043 |
| | | Sig. (2-tailed) | 0.540 |
| | | N | 206 |

### 3.1.5. The correlation between university differences and environmental problem-solving skill

The fifth research problem is to find out the correlation between school differences and solving environmental problems. To analyze the correlation using Spearman's rho method. The findings can be seen in Table 7. Based on the results of the statistical correlation between differences in university location and problem-solving skill, it is known that the value of the correlation coefficient was -0.369, which means the level of correlation between university variables and problem-solving abilities was very weak. The correlation coefficient level was negative so the correlation was not in the same direction. sig (2 tailed) was worth 0.000 or less than 0.05. Therefore, there was a correlation between the university and the environmental problems solving skill.

Table 7. Correlation between university differences and environmental problem solving

| Statistical method | Indicator | Statistical measure | Value |
|---|---|---|---|
| Spearman's rho | Environmental problem-solving skills | Correlation coefficient | -0.369 |
| | | Sig. (2-tailed) | 0.000 |
| | | N | 206 |

### 3.1.6. The effect of learning styles, gender, and university differences on the environmental problem-solving skills

The last research question that will be answered is knowing the influence between differences in learning styles, gender, and university on the skill to solve environmental problems. The first thing that known is the influence of differences in learning styles on the skill to solve environmental problems. The detail is presented in Table 8.

It can be seen in Table 8 that the learning style, the R-value was 0.113 which indicated a very weak correlation number between learning styles and problem-solving abilities. The significance value was greater than 0.05. Hence, it can be interpreted that there was no influence between learning styles and problem-solving skill. The result show that gender is able to influence the problem-solving skill with a significant value of F=1.257, p<0.05, but what is seen in the ANOVA column with an effective contribution of 0.9% or the contribution was very small. The difference in problem-solving skill between men and women was b=41,415; p<0.05. Significance value of 0.264 means was greater than 0.05, it can be concluded that there was no influence between gender and problem-solving skill. The result show that university have an effect on problem-solving skill (F=0.029) with a significance of p smaller than the significance value of 0.05. The significance value of university variables with problem-solving skill was greater than 0.05, meaning that

there was no influence between university and problem-solving skill. To see the influence of different learning styles, gender, and university on the skill to solve environmental problems as a whole, researchers used multiple regression analysis as presented in Table 9. It can be seen in the table that simultaneously the learning style, gender and university variables are able to influence problem solving abilities by 0.515. The mean square value is 56.028. However, the effective contribution of this variable is only 2.2%, which means it is very small.

Table 8. Learning style, gender and university influences on problem-solving skill

| Model | R | R. Square | Regression | | | | Unstandardized coefficients | Sig |
|---|---|---|---|---|---|---|---|---|
| | | | Sum of square | Df | Mean square | F | B constant | |
| Learning style | | | | | | | | |
| 1 | 0.113 | 0.013 | 192.156 | 3 | 64.052 | 0.596 | 40.857 | 0.000 |
| Visual | | | | | | | -1.533 | 0.613 |
| Auditory | | | | | | | -0.232 | 0.951 |
| Reading | | | | | | | 1.168 | 0.718 |
| Gender | | | | | | | | |
| 1 | 0.047 | 0.002 | 53.474 | 1 | 53.474 | 0.448 | 42.044 | 0.504 |
| University | | | | | | | | |
| 1 | 0.020 | 0.000 | 6.258 | 2 | 3.129 | 0.029 | 41.250 | 0.000 |
| A | | | | | | | -1.064 | 0.842 |
| B | | | | | | | -0.772 | 0.885 |

Table 9. Effect of learning style, gender, and university differences on the environmental problem-solving skills

| Model | R | R. square | Regression | | | | Unstandardized coefficients | Sig. |
|---|---|---|---|---|---|---|---|---|
| | | | Sum of square | Df | Mean square | F | B Constant | |
| 1 | 0.149 | 0.022 | 336.165 | 6 | 56.028 | 0.515 | 43.685 | 0.000 |
| Visual | | | | | | | -1.690 | 0.581 |
| Auditory | | | | | | | -0.174 | 0.964 |
| Reading | | | | | | | 0.971 | 0.766 |
| Men | | | | | | | -2.075 | 0.254 |
| A | | | | | | | -1.414 | 0.795 |
| B | | | | | | | -1.812 | 0.742 |

### 3.2. Discussion

Problem-solving skills require strategies to create higher-order thinking skills to solve problems. This strategy can be implemented in learning activities that have the ultimate goal of solving problems. The problem-solving skill strategy is designed to get answers to problems and solutions to problem-solving faced [1], [20]. This process requires higher-order thinking skills, which are carried out through a series of learning activities and the incorporation of previously owned experiences [32]–[34]. These activities and experiences are a provision to solve problems that have never been encountered or discovered before.

The results showed that the trend of student learning styles in the visual category. This result is caused by students preferring to see the object of the image or graphic that the teacher shows with various colors and shapes [35]. The research results also revealed that the kinesthetic learning style had the lowest results. Research findings show that students tend to prefer watching videos. As a result of deepening the research findings, students prefer to get information from cellphones by opening social media such as Tik Tok, Instagram, and YouTube to search for new information. Meanwhile, carrying out real actions such as cleaning up rubbish in the classroom environment is less interesting for students. This is in line with other studies which state that visual learning styles are more dominant than other learning styles [36]. Other research actually shows that adult learning styles are not permanent [37].

The findings also indicate that between gender and university differences there were no significant differences regarding learning styles. Male students tend to have visual, auditory and kinesthetic learning styles. Only, on the research findings, the tendency of female students to have a reading style of learning. The results of interviews with several female students who had a reading learning style stated that they were more accustomed to reading fictional essays such as novels, thus affecting their learning styles. Meanwhile, men prefer watching videos, listening to the news, and carrying out outdoor studies. This is supported by previous research [38] which states that there are no gender differences and learning styles from medical students in Saudi Arabia. Likewise, previous research results [39] showed that there are no differences in learning styles among secondary school students in Indonesia.

The next concern is the result of the environmental problem-solving skills in students in the low category. Students are able to describe and formulate problems. However, the ability to obtain information, test research hypotheses, and provide problem solving solutions is still very low. This is evidenced by the students' answers which are general and do not provide many alternative problem solutions and are less able to practically explain the solutions offered. This is in line with previous research which stated that the more often problem-solving learning activities are carried out in the classroom, the more trained students will be in solving problems [40], [41]. Geographical learning activities that have been carried out so far still do not lead students to higher levels of thinking such as solving problems. For this reason, changes in the geography learning process are needed.

On the skill to solve environmental problems seen from university differences, significant differences were found between University A, B, and C. The higher tendency for solving environmental problems was found in university A located in the city center, university in densely populated settlements, and university C in the countryside. This is thought to be caused by the availability of more complete learning facilities in university A. On the other hand, environmental problems in the city are more complex than in other locations, so students are trained to think in a complex way and are directly confronted with environmental problems contextually, in contrast to University C which is on the countryside. Providing learning facilities that are able to accommodate students in problem-solving thinking. The correlation between problem-solving skill and geography learning lies in activities during the learning process [2].

The environmental problem-solving skills based on gender in this study was superior to women 1.15% of men. This is in line with previous research which states that women are better able to do various kinds of work at one time so that women can think of answers to problem-solving when collecting facts and data [42]. Whereas men in solving problems, they must focus on each step individually [43]–[45]. However, other studies also contradict the opinions of this study and previous studies that support the findings. According to the study, men were superior in problem-solving especially in the field of mathematics and analysis of spatial patterns [46].

Another research finding is that there is no correlation between learning styles and environmental problem-solving abilities. Research findings show that differences in learning styles show no significant influence. Students with different learning styles still show low environmental problem-solving abilities. On the other hand, women's environmental problem-solving abilities are superior to men. However, the correlation value is very low (0.043) so it can be concluded that there is no correlation between gender differences and environmental problem-solving abilities. The same thing was also found in differences in the geographical location of universities. Even though University A has advantages over Universities B and C, there is no general correlation found in environmental problem-solving abilities.

Previous studies showed that an effort is needed to improve the skill to solve environmental problems. These efforts can be in the form of providing learning facilities [47], implementation of learning models [48]–[50], learning media [51], and developing problem-solving learning evaluation tools [52]. The teacher is also expected to be able to motivate students to do problem-solving and also continue to improve their competence [47].

Based on research findings, it is known that individual learning needs are very different. Universities should accommodate differences in learning needs by providing facilities to support their needs without differentiating between genders. Furthermore, the research results also show that the ability to solve environmental problems in general is still in the low category. Therefore, the practical implication that can be made is that the learning content for solving environmental problems can be massive across all discussion themes without being limited to course achievements. The direction of educational policy is required to include the ability to solve environmental problems more clearly and be included in the main learning objectives achieved by college graduates.

## 4. CONCLUSION

Based on this study, it was found that students' learning styles tend to be in the visual learning style group. In the learning style group, no significant differences were found between gender and university location. Furthermore, on the environmental problem-solving skills, the condition of students is still at a low level of ability, this is evidenced by the low score of students when providing alternative solutions to the problems presented. The environmental problem-solving skills do not have a significant difference between gender differences but have significant differences in different university locations.

This study provides evidence that there is not any correlation between learning styles and gender in the environmental problem-solving skills, but this has a significant correlation when viewed from the differences in university locations. Other findings that also reinforce the influence of the university differences on the type of learning that has a significant effect, but has a very weak correlation. Furthermore, overall differences in learning styles, gender, and university do not affect the ability to solve environmental

problems. Efforts to improve the environmental problem-solving skills which can be done based on the study is that learning in order to accommodate the tendency of students' visual learning styles through learning in class can be in the form of providing learning facilities such as books, pictures, maps, and diagrams.

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