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Development of Local Potential-Based Environmental Care Instrument and its Ability to Reveal Students' Caring Attitudes at Genders and Grades

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This study aimed to develop an environmental care instrument for students based on local potential and test its effectiveness on different genders and grades. This research is development research of three stages, i.e., literature analysis and preparation of instrument items, the validity of instrument content, and constructs validity using EFA and CFA. The instrument consists of 25 positive and negative statement items using 5 rating scales. The environmental care attitude instrument development results have met the criteria of construct validity through EFA and CFA. The EFA validation yielded 23 items (1 item eliminated from the 1st EFA and another from the 2nd EFA). The results of the final validation using CFA showed that all items met the fit criteria and formed three factors. The analysis results of the instrument effectiveness show that the instrument has been able to reveal students' environmental care attitudes which is differentiated by gender and grade. The results of the analysis showed that female students have a better environmental care attitude than male students and students of class XI have a better environmental care attitude than students of class X. Overall, the instrument has met content and construct validity and is effectively used to reveal students' environmental care attitudes.

Keywords: environmental care attitude, local potential, gender, grade, attitude

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INTRODUCTION

Attitude is a latent construct related to concrete or abstract objects such as people, places, entities, and ideas. Environmental care attitude is a concern for environmental issues (Gifford & Sussman, 2012). Environmental attitude is a psychological reflection that describes the likes and dislikes of the environment (Milfont & Duckitt, 2010). Caring for the environment is essential for students to have a sustainable future (Otto et al., 2019). Currently, the environmental damage caused by humans is very massive, so understanding and behavior of caring for the environment are essential for a person to have (Kalburan & Hasiloglu, 2018). On the other hand, the lack of human concern for the environment can cause damage and negatively impact both the environment and humans, so cultivating and growing an attitude of caring for the environment is very important (Palupi & Sawitri, 2018).

Instruments to measure students' environmental care attitudes have been widely used. Each study has its characteristics and objectives. Uzun et al. (2019) has developed an environmental care attitude instrument for students at the elementary, middle, and college levels. Furthermore, Uzun et al. (2019) tested three constructs: behavior, opinion, and emotion towards the environment. The results of this study indicate that the construct has met good validity and reliability using exploratory factor analysis. In addition, Ugulu et al. (2013) have developed an instrument of environmental care attitude which includes four constructs, namely (1) environmental awareness; (2) attitudes towards recovery; (3) attitudes towards recycling; and (4) environmental consciousness and behavior. A similar study was also conducted by Fernández-Manzanal et al. (2007), which revealed four aspects of environmental attitudes: education, work or field trips, conservation, and disposition to act. Each researcher has their definition and framework of environmental care attitude, so constructs that have been developed to measure the attitude are different.

On the other hand, developing an environmental care attitude instrument is also needed to measure students' concern for the local potential of natural resources in their environment. In the case that occurred in Indonesia, most students do not understand the local potential of natural resources in their respective regions, so an introduction to the local potential is needed so that students can preserve their environment (Sukri et al., 2018). So far, no research that develops local potential-based environmental care instruments has been found. Therefore, this research is fundamental because (1) students can understand the local potential around them, (2) through this instrument, students' environmental care attitudes, especially towards natural resources around them, can be determined, (3) increase students' understanding of local potential, which in the end, to protect and preserve the environment, (4) can be used as a reference for other researchers who want to develop an environmental care attitude, (5) this research is pioneer research that develops a local potential-based environmental care instrument.

Revealing students' environmental care attitudes need to be conducted because individuals who have negative attitudes towards the environment will not act on environmental problems (Gökmen, 2021). Previous studies have shown different results. The meta-analysis conducted by Gökmen (2021) revealed that males have a better

environmental care attitude than females, while other studies report that females have a better environmental care attitude than males (Erdogan et al., 2012; Gökçe, N., & Sarıyar, 2019). Differences in caring attitudes between male and female students are influenced by emotions and psychological characteristics, traditions, family, and even other environmental factors (Gökmen, 2021). The difference in the study results became the basis for the importance of revealing the environmental care attitude of students of different genders. This study aimed to develop an instrument for students' environmental care attitudes and test their ability to reveal students caring attitudes at different genders and grades.

METHOD

Instrument Development

The development of the local potential-based environmental care attitude instrument was carried out through several stages, namely literature analysis and preparation of instrument items, the validity of instrument content, and constructs validity using EFA (Surastina, 2018) and CFA (Uzun et al., 2019; Lukitasari et al., 2022; Sukri et al., 2022). The environmental care attitude instrument preparation was carried out through an analysis of literature originating from primary sources, especially articles published in reputable international journals. After going through a series of literature analyses, 25 statement items were assigned with symbols of S1 to S25 covering three indicators, namely awareness of protecting the environment, behavior in maintaining cleanliness and using nature well, and knowledge of local potential. These three indicators are considered to have represented the environmental care attitude, and each item contains aspects of local potential. Statements were made in the form of negative and positive statements. For positive statements, five scales were used to measure students' environmental care attitudes, namely 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree, while for negative statements the opposite applied. After compiling the instrument, then content validation was carried out (Artvinli & Demir, 2018) by validators with expertise in the fields of environment, social humanities, and learning technology. Content validity follows the content validity index (CVI) criteria by DeVon et al. (2007), with the acceptance criteria for CVI values > 0.79.

The construct validation of the instrument was carried out through Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analysis (CFA). The survey for the analysis of EFA and CFA was conducted on 430 high school students from 25 schools in West Nusa Tenggara, Indonesia. Schools were randomly selected and taken from 2 regions representing the Province of West Nusa Tenggara, namely Lombok and Sumbawa islands. The pre-analysis of EFA used Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity scores (Hair et al., 2010; Chan, L. L., & Idris, 2017; Surastina, 2018), while the EFA acceptance criteria used a loading factor value > 0.3 (Desstya et al., 2019) and Eigenvalue >1 (Yong, A. G., & Pearce, 2013). The fit criteria for the EFA were tested through the CFA using the Goodness of fit index (GFI), Root mean square error of approximation (RMSEA), Tucker-Lewis Index (TLI), and Comparative Fit

Index (CFI) criteria (Sun, 2005; Zainudin et al., 2019; Tomé-Fernández et al., 2020; Tungkunanan, 2020; Siewseng et al., 2020).

Instrument Effectiveness

To determine the effectiveness of the instrument, a trial was conducted on 413 high school students in West Nusa Tenggara, Indonesia. The criteria for the ability of the instrument were reviewed based on the ability of the instrument to reveal the students' environmental care attitude, which is differentiated by gender and grade. Students' environmental care attitudes are categorized into four levels, namely not care (<31.25), weak (31.25-62.50), good (63.50-93.75), and very good (≥95) (Istiqomah et al., 2020). To find out the differences in students' environmental care attitudes at different genders and grades, a one-way ANOVA analysis was carried out (Yeager, 2021).

FINDINGS AND DISCUSSION

Exploratory Factor Analysis (EFA)

The construct validation of the environmental care attitude instrument was carried out through exploratory factor analysis (EFA). Factor analysis is used to reduce variables and establish the underlying dimensions between measured variables and latent constructs, thus enabling the formation and improvement of theory (Williams et al., 2010). This statistical method is one of the fundamental tools in developing and validating instruments (Watkins, 2018). Factor analysis was performed on 25 statement items in the instrument. Prior to factor analysis, a prerequisite test was carried out to determine the adequacy of the sample numbers through the Kaiser-Meyer-Olkin value (Hair et al., 2010; Hadia et al., 2016) and the relationship between variables in the factors seen based on the value of Bartlett's Test of Sphericity (Chan & Idris, 2017; Mohd Matore et al., 2019). The results of the KMO and BTS analysis are shown in Table 1.

Table 1
Prerequisite test for KMO and BTS

Bartlett's Test of Sphericity			Kaiser-Meyer-Olkin
X^2	df	p	Overall MSA
3514.376	300.000	<0.001	0.867

The KMO and BTS analysis results in Table 1 show the KMO value = 0.867. This indicates that the EFA analysis has met the sample numbers to be analyzed. According to Hair et al. (2010), the KMO value > 0.5 indicates the adequacy of the sample number in the EFA prerequisite test. The p-value of the BTS test in Table 1 shows <0.001; this is evidence that there is a relationship between variables in the EFA so that it can be continued to the next stage of analysis (Field, 2000). After the two assumptions were met, then factor analysis was carried out on 25 items to determine the number of constructs formed using the parallel analysis method (Çokluk & Koçak, 2016), varimax rotation (Osborne, 2015), maximum likelihood estimation, and factor loading minimum value of 0.3 (Desstya et al., 2019). The numbers of factors formed, the value of each item's factor loading, variance, Cronbach's alpha, and between and inter-factor correlations are shown in Table 2.

Table 2
Characterization of factors formed from EFA

Variable		Factor 1	Factor 2	Factor 3
Items	S1			0.470
	S2			0.589
	S3			0.885
	S4			0.858
	S5			0.696
	S6		0.570	
	S7		0.545	
	S8	0.329		
	S9	0.619		
	S10		0.547	
	S11		0.453	
	S12		0.410	
	S13		0.506	
	S14		0.430	
	S15		0.410	
	S16			
	S17	0.449		
	S18		0.428	
	S19	0.746		
	S20	0.806		
	S21	0.624		
	S22		0.407	
	S23	0.652		
	S24		0.465	
	S25		0.535	
Varians		13.90	12.60	10.60
Alpha cronbach		0.810	0.808	0.827
Average interitem correlation		0.390	0.261	0.473
Average interfactor correlation		0.059	0.072	0.003

The results in Table 2 show that the number of constructs formed from EFA is three constructs. Item S16 is eliminated from the factor because it has a loading factor of less than 0.3. The total variance formed from all factors is 37.10%; this value is still acceptable even though for humanities research, the tendency for the total variance formed is usually 50-60% (Pett et al., 2011). Allegedly, the selection of the extraction method has caused the low value of the variance formed. According to Costello & Osborne (2005), the maximum likelihood (ML) method produces a smaller variance than the principal component analysis (PCA) method. The three factors formed also have good reliability values with a range of Cronbach's alpha values of 0.808 to 0.827. In addition, the instrument has good specificity because it can distinguish one factor from another (Trumpower et al., 2010). This can be observed through the mean values of interitem correlation in factors are greater than the average values of correlation between factors.

The results in Table 2 are strengthened by the eigenvalues of each factor formed (Figure 1). The eigenvalue is used to determine the number of factors formed (Larsen & Warne, 2010). Based on Figure 1, the Eigenvalue for all constructs is >1. This shows that the formed factors have met the fit criteria (Yong, A. G., & Pearce, 2013). In addition, the inflection point is formed after three factors, this is evidence that the number of factors or constructs formed from EFA is three constructs. The constructs formed were then labeled according to the characteristics of each factor, namely factor 1 = awareness of protecting the environment, factor 2 = behavior in maintaining cleanliness and using nature well, and factor 3 = knowledge of local potential. The three constructs or factors formed were then tested using confirmatory factor analysis (CFA) to determine the consistency of the formed factors.

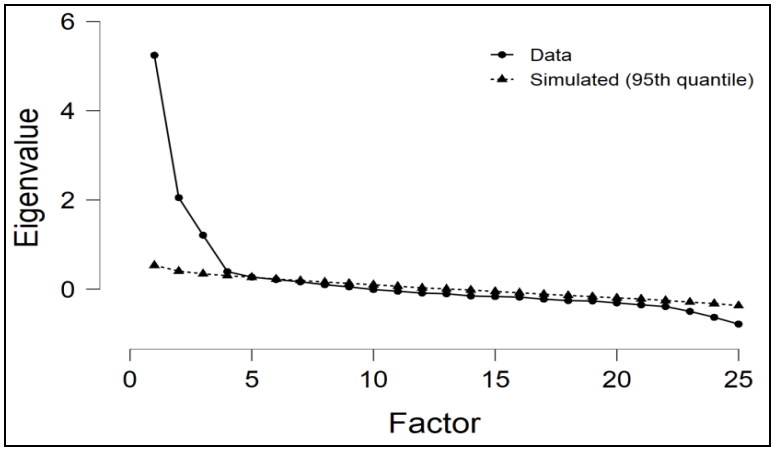

Figure 1
Scree plot of EFA results

Confirmatory Factor Analysis (CFA)

CFA analysis was carried out on three factors formed from the EFA results. The consistency of the factors formed is measured based on the criteria of the model fit, which includes the Goodness of fit index (GFI), Root mean square error of approximation (RMSEA), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and X^2/df (Sun, 2005; Tomé-Fernández et al., 2020). If the CFA results do not meet all of these criteria, then a modification is made to the factor analysis by eliminating the item that has the smallest value of factor loading. The results of the CFA analysis are shown in Table 3.

Table 3
Results of CFA analysis

Index	Value	Cut off value	Criteria
Goodness of fit index (GFI)	0.895	≥0.95	Not good
Root mean square error of approximation (RMSEA)	0.059	≤0.06	Good
Tucker-Lewis Index (TLI)	0.873	≥0.95	Not good
Comparative Fit Index (CFI)	0.885	≥0.95	Not good

The model fit analysis in Table 3 shows that some criteria do not meet the eligibility factors, such as GFI, TLI, SCI, and X^2/df. Therefore, the factors formed are not yet fixed, and it is necessary to eliminate items with the smallest loading factor values. In this study, the minimum loading factor value, which was previously 0.3, was increased to 0.4 to obtain consistency in item-grouping and discard items with small correlation values between factors. The results of factor-grouping after modification are shown in Table 4.

Table 4
Second EFA result

Variable		Factor 1	Factor 2	Factor 3
Items	S1			0.470
	S2			0.589
	S3			0.885
	S4			0.858
	S5			0.696
	S6		0.570	
	S7		0.545	
	S8			
	S9	0.619		
	S10		0.547	
	S11		0.453	
	S12		0.410	
	S13		0.506	
	S14		0.430	
	S15		0.410	
	S16			
	S17	0.449		
	S18		0.428	
	S19	0.746		
	S20	0.806		
	S21	0.624		
	S22		0.407	
	S23	0.652		
	S24		0.465	
	S25		0.535	
Varians		13.90	12.60	10.60
Alpha cronbach		0.810	0.808	0.827
Average interitem correlation		0.390	0.261	0.473
Average interfactor correlation		0.059	0.072	0.003

The results of the second EFA analysis show that there is no change in the formed factors. One item was eliminated from the factor, namely item S16. Meanwhile, for other variables such as variance, Cronbach's alpha value, Average interitem correlation values, and Average interfactor correlation values do not change. Furthermore, from the factors formed based on the results of the second EFA analysis, a second CFA analysis

was carried out to confirm the formed factors. The results of the second CFA analysis are shown in Table 5, while the final construct structure formed is shown in Figure 2.

Table 5
Second CFA result

Index	Value	Cut off value	Criteria
Goodness of fit index (GFI)	0.964	≥0.95	Good
Root mean square error of approximation (RMSEA)	0.042	≤0.06	Good
Tucker-Lewis Index (TLI)	0.967	≥0.95	Good
Comparative Fit Index (CFI)	0.970	≥0.95	Good

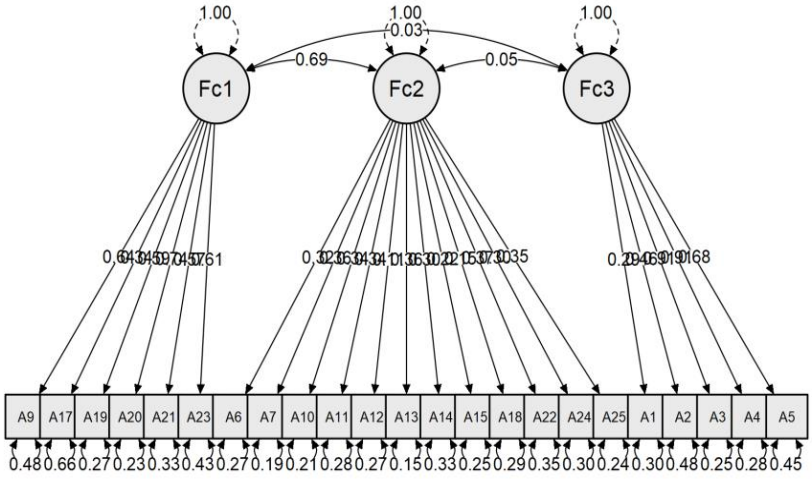

Figure 2
CFA's final construct structure

Instrument Effectiveness

The instrument's effectiveness is measured by its ability to reveal students' environmental care attitudes based on different genders and grades. In addition, the effectiveness of the instrument was also measured through the instrument's ability to differentiate students' environmental care attitudes on gender and grade, which were analyzed using the one-way ANOVA test.

The students' environmental care attitudes at different genders and grades

The analysis results of students' environmental care attitudes at different genders indicate that both male and female students have different environmental attitudes. Students' environmental care attitudes are categorized into weak, good, and very good, as shown in Figure 3.

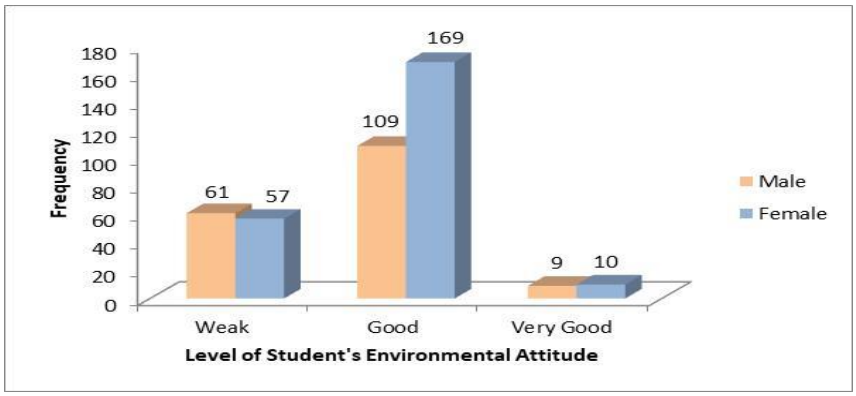

Figure 3
Graph of students' environmental care attitudes at different genders

Figure 3 reveals the level of students' environmental care attitudes. The results of the descriptive analysis showed that students' attitudes were included in three categories, namely weak, good, and very good. The number of students who have a weak category level for both male and female students is not much different. Likewise, both male and female students have not significantly different frequencies at a very good level. The difference in students' environmental care attitudes is in a good category. The number of female students who have environmental care in the good category is higher than the male students. Overall, students have environmental care attitude, although a small percentage of students' attitudes are in the weak category. However, all students care about their environment. These results illustrate that the instrument has revealed the students' environmental care attitudes. To strengthen these results, further analysis was carried out to reveal the level of students' environmental care attitudes at different grade levels. The results of the descriptive analysis of students' environmental care attitudes at different grades are shown in Figure 4.

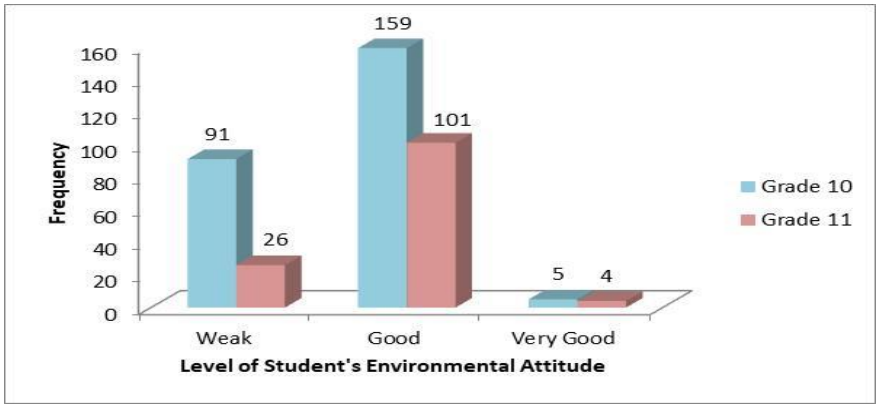

Figure 4
Graph of students' environmental care attitudes at different grades

The analysis results of students' environmental care attitudes at different grades in Figure 4 show that students' attitudes are divided into three levels: weak, good and very good. These results reveal that, in the weak and good categories, the frequency of students' environmental care attitudes in grade 10 is higher than in grade 11. Meanwhile, the frequency of students who have environmental care attitudes is not significantly different for the very good level. These results also reveal that both classes have a low environmental care attitude for the very good category. To strengthen these results, statistical analysis is needed to reveal differences in students' environmental care attitudes on gender and grade through the one-way ANOVA test.

Differences in Environmental Care Attitudes at Different Genders

To find out the differences in students' environmental care attitudes at different genders, a one-way ANOVA test was conducted. Prior to that, the prerequisite test for normality and homogeneity was carried out, which are shown in Table 6.

Table 6
Prerequisite test for normality and homogeneity

Variable	Normality Test (Kolmogorov-Smirnov)			Homogeneity Test (Levene test-based on median)		
	Statistic	df	Sig	Levene Statistic	df2	sig
Gender	1.130	415	0.156	0.966	413	0.326

The prerequisite analysis results in Table 6 show that the independent variable data are normally distributed and have a homogeneous variance. With the fulfillment of all prerequisite tests, the one-way ANOVA test can be continued. Pre-analysis using descriptive statistics in Table 7 shows that the average value of male students' environmental care attitudes is lower than female students with an average of 66.06 and 70.21, respectively. These results indicate that female student have better attitudes than male students. However, the results need to be reclarified using the one-way ANOVA test to find out the differences in environmental care attitudes between male and female students, whose results are shown in Table 8.

Table 7
Descriptive analysis of students' environmental care attitudes

variable	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Male	179	66.0615	17.73689	1.32572	35.00	100.00
Female	236	70.2119	16.71277	1.08791	35.00	100.00
Total	415	68.4217	17.26402	.84746	35.00	100.00

Table 8
The results of the one way ANOVA analysis of students' environmental care attitudes

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1753.474	1	1753.474	5.954	0.015
Within Groups	121637.731	413	294.522		
Total	123391.205	414			

The results of the one-way ANOVA analysis in Table 8 show differences in the environmental care attitude values of male and female students (p-value = 0.015). Furthermore, these results reveal that female students have better environmental care attitudes than male students, with a mean score of 70.21, while male students have an average score of 66.06 (Table 7). This value, when converted into a scale or category of environmental care, according to Istiqomah (2020), both are in a good category. However, quantitatively it proves that female students tend to have a better environmental care attitude than male students (Figure 2). This result reinforces the results of the previous study, which found that female students' environmental care attitudes are higher than male students (Özsoy, 2012; Newman & Fernandes, 2016; Gustria & Fauzi, 2019). The high environmental care attitude in female students is probably due to females' feelings. This is reinforced by Kose et al. (2011), who revealed that female students have better sensitivity to the environment than male students. These results prove that the instrument has been able to reveal students' environmental care attitudes that are differentiated by gender.

Differences in Environmental Care Attitudes at Different Grades

To determine the instrument's effectiveness in revealing students' environmental care attitudes, a one-way ANOVA test was conducted to test the differences in students' environmental care attitudes based on grade or class. Before the statistical test, the prerequisite test for normality and homogeneity was carried out which are shown in Table 9.

Table 9
Prerequisite test for normality and homogeneity

Variable	Normality Test (Kolmogorov-Smirnov)			Homogeneity Test (Levene test-based on median)		
	Statistic	df	Sig	Levene Statistic	df2	sig
Grade	2.937	386	0.142	1.199	384	0.274

The results of the normality and homogeneity test

Table 9 shows that the data are normally distributed and have a homogeneous variance. Because it has a homogeneous variance and is normally distributed, the one-way ANOVA test can be continued. The results of the descriptive analysis in Table 10 show that the average value of students' environmental care attitudes in class 11 is higher than class 10, with an average of 73.09 and 64.45, respectively. These results indicate that students in class 11 have a better attitude than those in class 10. These results need to be strengthened using the one-way ANOVA test to determine differences in environmental care attitudes between classes 10 and 11, which are shown in Table 11.

Table 10
Descriptive analysis of students' environmental care attitudes based on grade

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Class 10	255	64.4510	17.09436	1.07049	35.00	100.00
Class 11	131	73.0916	15.98627	1.39673	40.00	100.00
Total	386	67.3834	17.20067	.87549	35.00	100.00

Table 11
Results of one way ANOVA analysis at different grades

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6461.216	1	6461.216	23.092	.000
Within Groups	107446.038	384	279.807		
Total	113907.254	385			

The results of the one-way ANOVA analysis in Table 11 show that there are differences in the environmental care values of students in classes 10 and 11 (Sig < 0.000). The analysis results revealed that the value of the environmental care attitude of class 11 students was higher than that of class 10 (Table 10). These results indicate that the higher the level, the higher the students' environmental care attitude. The results of this study are in line with those of Şahin & Erkal (2012) and Erdogan et al. (2012), who found that upper-level students had better environmental attitudes than lower-level students. Overall, these results reveal that the instrument has good distinguishing power and effectiveness in revealing students' environmental care attitudes in terms of gender and grade.

CONCLUSION

The results of the development of local potential-based environmental care instruments have met the criteria for construct validity through EFA and CFA analysis. The EFA validation results yielded 23 items (1 item was eliminated from the 1st EFA and another from the 2nd EFA). The results of the final validation using CFA show that all items met the fit criteria and formed three factors, namely factor 1 = awareness of protecting the environment, factor 2 = behavior in maintaining cleanliness and using nature well, and factor 3 = knowledge of local potential. The results of the effectiveness analysis of the instrument show that the instrument has been able to reveal the students' environmental care attitudes differentiated by gender and grade. The results of the analysis show that female students have a better environmental care attitude than male students ($p<0.05$), and class XI students have a better environmental care attitude than those in class X ($p<0.05$). Overall, the instrument has met content and construct validity and is effectively used to reveal students' environmental care attitudes. To strengthen the results obtained, further researchers can implement this instrument to measure caring attitudes at different levels of education.

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