International Journal of Education & Literacy Studies
ISSN: 2202-9478
www.ijels.aiac.org.au

Perception of Ecological Literacy in Education: A Scale Development Study

Erol Koçoğlu[1]*, Şule Egüz[1], Rasim Tösten[2], Fatıma Betül Demi[3], Danyal Tekdal[1]

[1]*Faculty of Education, İnönü University, Malatya, Turkey*
[2]*Faculty of Education, Siirt University, Siirt, Turkey*
[3]*Faculty of Education, Bartın University, Bartın, Turkey*

Corresponding author: Erol Koçoğlu, E-mail: erolakademi@gmail.com

ARTICLE INFO

Article history
Received: April 06, 2023
Accepted: July 08, 2023
Published: July 31, 2023
Volume: 11 Issue: 3

Conflicts of interest: None
Funding: None

ABSTRACT

The increase in the world population day by day affects the balance of the living world, nature, and environment. Due to unawareness and misuse, the emergence of some environmental imbalances causes the formation of ecological problems. In order to prevent the emergence of these problems or to combat them, everyone in the education process should have an awareness level of ecological literacy. The aim of the research conducted in this direction is to develop a valid and reliable measurement tool for determining the ecological literacy levels of teachers. Within the framework of the purpose of the research, a literature review on ecology and ecological literacy was conducted. An item pool of 96 items was created. Language, meaning and content validity of the items forming the trial scale form was ensured. The data of the research were obtained with the participation of 879 teachers working in public schools in Turkey. Exploratory and confirmatory factor analyses were performed on the obtained data. The final ecological literacy scale consists of three different components: cognitive (α:.84), affective (α:.87), and behavioral (α:.92) attitudes. According to the results of the analysis, it can be said that the scale developed is reliable enough to measure teachers' ecological literacy attitudes.

Key words: Ecological Literacy, Scale Development, Education, Teacher

INTRODUCTION

Ecology is a developing and expanding branch of science that studies the interactions of living and non-living things and their relationship with their environments. The concept of literacy and the skills it contains vary. In this context, ecological literacy can be defined as transferring positive attitudes to life by developing a rich knowledge base with skills and values (Demir, 2021a). More specifically, ecological literacy means knowing the basic principles of ecology and using them in daily life, developing an understanding of how to conserve ecology by understanding man's place in the environment, and being able to recognize ecological problems and produce effective solutions to these problems.

Defining ecological literacy, which is the subject of the research, can be expressed as a very complex situation due to the different skills and components it includes (Jordan et al., 2009; Demir, 2021a). When the scientific studies on the research subject are examined, it can be said that different definitions are made. Ecological literacy, the ability to understand the interdependence of living with the concern to act on practical competences and knowledge (Inda, 2008); individuals' use of knowledge and understanding of ecological concepts in their lives and lifestyles (Lebo III, 2012); It is defined as a broad literacy (Demir, 2021a) that emphasizes the understanding of human and nature interaction with a system approach and the acquisition of cognitive, affective and operational competencies accordingly. When we look at the definitions of ecological literacy, it can be said that increasing environmental awareness within the framework of competence, awareness, knowledge and harmony comes to the fore.

The term ecological literacy was used for the first time by Risser in his speech to the American Ecological Association in 1986. Risser urged ecologists to take a strong stance on what constitutes basic ecological literacy, and to embrace their responsibilities as promoters of ecological literacy and to participate in the discussion. In 1992, David Orr, Professor of Environmental Studies and Policy, coined the term ecological literacy in his book *Ecological Literacy*. Thus, ecological literacy has become the most used term in ecology (Boehnert, 2013; McBride et al., 2013; Casper & Balgopal, 2018; Demir, 2021a). In Turkey, the concept of ecological literacy was first introduced by TEMA in 2011 with "Ecological Literacy Teacher Training". With this training, a very important step has been taken for the generation of 'readers and writers', in other words 'knowing and practicing' in nature, for the first time in Turkey (Turkish Foundation for Combating Erosion, Afforestation and Conservation of Natural Assets [TEMA], 2019).

Ecological literacy varies in purpose due to the dimensions it includes. Some of these aims are "to address issues of

Published by Australian International Academic Centre PTY.LTD.

http://dx.doi.org/10.7575/aiac.ijels.v.11n.3p.3

agriculture, shelter, energy use, urban design, transportation, economy, society, resource use and forestry; make changes about the future of life based on a comprehensive, holistic and similar understanding of the interrelationships between natural systems and human systems; understand the contextual and relational aspects of ecological well-being and learning as central to the pursuit of sustainability; to equip individuals with the necessary knowledge and competencies to deal with the solution of ecological problems holistically; to create a sustainable lifestyle that recognizes relationships and interdependence with the natural world; respect and care for ecological requirements for the survival of humans and species; introduce new skills to respond effectively to ecological problems; steer school systems towards a sustainable future; thinking about ecological problems based on ecological knowledge, etc." can be sorted (Orr, 1992; Schwartz, 1999; Curthoys & Cuthbertson, 2002; Cutter Mackenzie & Smith, 2003; Berkowitz et al., 2005; Wooltorton, 2006; Borden, 2007; Puk, 2012; Boehnert, 2013; Megat Jiwa, & Esa, 2013; Pitman & Daniels, 2016; Demir, 2021a). In line with these purposes, some awareness-based updates are required due to the need variability of the world and the environment we live in (Koçoğlu & Egüz, 2019; Koçoğlu & Demir, 2021a). This research was conducted to determine the impact of ecological literacy on these updates. Studies conducted on the subject in Yalçınkaya (2012), Demir (2016), Çetin and Yalçınkaya (2018) can be stated to positively affect cognitive and affective readiness regarding ecological literacy.

METHOD

In this research, which was designed as a scale development study, the information about the teachers participating in the study was given under the title of "universe and sample", item writing and drafting were given in the first step, the preparations before the data analysis process were given in the second step, and the validity and reliability studies were given in the third step.

Universe and Sample

The universe of the research consists of teachers working in public schools in Turkey. In order to conduct reliability and validity analyzes in scale studies, the number of samples should be at least five and at most ten times the number of scale items (Tavşancıl, 2018). In this context, it can be said that since the number of scale items in the study was 96, the sample size was 879 people in total, and the scale data was sufficient for the item analysis. In the scale development study, two different participant groups were formed for exploratory and confirmatory factor analysis. The first group consists of 400 teachers and the second group consists of 479 teachers. Information on the participant groups is given in Table 1.

As seen in Table 1, 400 teachers participated in the first application group of the study and 479 teachers participated in the second application group. In the first application group, 129 women, 271 men, 177 women and 302 men in the second group. Positions of duty differ from provinces, districts and villages. Looking at the seniority of the teachers, there are teachers who have a seniority starting from 1 year and up to 31 years and above. In this respect, the personal characteristics of the participants in the study vary.

Table 1. Information of the participants in the study

First set of set of applications			Second set of applications		
	f	%		*f*	%
Gender					
Famale	129	32.3	Famale	177	37.0
Male	271	67.8	Male	302	63.0
Total	400	100.0	Total	479	100.0
Experience					
1-10 Years	127	31.8	1-10 Years	122	25.5
11-20 Years	186	46.5	11-20 Years	225	47.0
21-30 Years	75	18.8	21-30 Years	114	23.8
31 years and above	12	3.0	31 years and above	18	3.8
Total	400	100.0	Total	479	100.0
Workplace					
Country	240	60.0	Country	330	68.9
Town	126	31.5	Town	120	25.1
Village	34	8.5	Village	29	6.1
Total	400	100.0	Total	479	100.0

Process Steps

In this section, the scale development stages are included. In the first step, the process of creating the item pool and getting it ready for pre-application; pre-application process in the second processing step; In the third step, it includes findings on item-total correlation, exploratory factor analysis, reliability analysis of internal consistency and confirmatory factor analysis for validity and reliability analysis.

First Processing Step: In the preparation of the scale, the scope of the scale was determined first. In this context, the theoretical framework for ecology, ecological literacy and environmental literacy has been determined. A literature review was conducted on the subject. It was decided to prepare the scale for teachers. An item pool should be created to be 5-6 times the total number of items planned to be implemented in the scale. As a result of the surveyed measurement tools and literature, a pool of 30 positive or negative scale items was created for cognitive attitude, 35 for affective attitude, and 31 for behavioral attitude. In order to determine the content and content validity of the items, arrangements were made in line with the opinions and suggestions of experts in the field of social studies education, curriculum development, measurement and evaluation, research methods and statistics, and a 96-item measurement tool was prepared for pre-application. While preparing this measurement tool, the following procedures were followed in the process:

1. Pre-evaluation of scale items,
2. Evaluation of the suitability of the scale items,

3. Ensuring the content and face validity of the scale items (Assessment and evaluation and receiving the opinions of Turkish language experts, field experts),
4. Before the measurement tool was applied, it was examined by teachers working in public schools in order to evaluate the scale items in terms of intelligibility and suitability. In addition, the opinions of field experts were consulted in order to ensure the content and face validity of the scale items (Assessment and Evaluation and Turkish Language Expert, etc.), and
5. As a result of the opinions regarding the scale items, necessary corrections and additions were made in the relevant items. Incomprehensible and repetitive items have been deleted. The "Ecological Literacy Scale", which has a total of 96 items in its final form, has been prepared for pre-application.

The measuring tool, which was given its final shape for the pre-application, consists of four parts. In the first part of the measurement tool, there are items measuring the cognitive attitudes of ecological literacy, in the second part, the items measuring the affective attitudes, in the third part, the items measuring the behavioral attitudes, and in the fourth part, the personal information part. For the first three sections, a 5-point Likert rating was made. According to this; It was defined as "1: Strongly Agree", "2: Agree Mostly", "3: Agree Moderately", "4: Agree Slightly" and "5: Agree Strongly".

In the evaluation of the arithmetic averages of the answers given by the participants to the research questions, "1.00-1.79 = Strongly Disagree", "1.80 – 2.59 = Agree Slightly", "2.60 – 3.39 = Agree Moderately", "3.40 – 4.19 = Agree Mostly", "4.20– 5.00 = Totally Agree" criteria are taken as basis. In this case, the ecological literacy levels of teachers who score 4.20 and above are "very good"; For 3.40-4.19 points, teachers are considered as "good", those with 2.60-3.39 points as "medium", teachers with 1.80-2.59 points as "low" and those with 1.00-1.79 points as "very low".

Second Process Step: The preliminary application of the research was carried out with the participation of teachers working in public schools. The number of participants required for the statistical analyzes to be meaningful and for the factor loadings to be evident after the pre-application is a matter of debate. Existing opinions are examined in three categories. These are: Number of items/number of observations, absolute number of observations and expected number of factors/number of observations (Yurdugül, 2013). Comfrey and Lee (1992) consider 300 participants as "good" for their absolute width of observation in factor formations. Osborne and Costello (2004) found that the ratio of the number of observations to be 11 times the number of factors. This research, the first application of which was carried out, was carried out with 400 teachers, exceeding three times the number of items for the 96-item measurement tool. In the second application, 479 teachers took part.

Data were collected again for the confirmatory factor analysis performed to test the construct validity of the study. In the second application of the study, there were 479 teachers who were similar to the schools in the universe but were not included in the first sample. As a result of the application, the findings related to the validity and reliability analyzes reached with the data collection tools are given in the following title.

Third Process Step: In this section, findings related to validity and reliability analyzes are given. Item-total correlation, factor loadings, explained variance, KMO value, Barlett sphericity value and Cronbach Alpha coefficient are included in the table.

For validity and reliability analysis, 96 items were included in the "Ecological Literacy Scale" before the pre-application. The reliability of the scale was tested by calculating the Cronbach's Alpha internal consistency coefficient and item-total correlations. In the reliability analysis, the items with item-total correlations below .30 were excluded from the evaluation, and validity and reliability analyzes were repeated.

Kaiser-Meyer-Olkin (KMO) value and Barlett Sphericity Test results were examined in order to test whether the scale is suitable for evaluation with exploratory factor analysis. The data set with a KMO value of .913 and a significant Barlett test ($p<.01$) was found to be suitable for factor analysis. Büyüköztürk (2002) stated that if the KMO coefficient is higher than .60 and the Barlett test is significant, the data are suitable for factor analysis. At this point, exploratory factor analysis was performed first to examine the construct validity of the scale, and then confirmatory factor analysis was applied to test the suitability of the model determined in exploratory factor analysis.

In the exploratory factor analysis, three different components (cognitive, affective and behavioral attitudes) were handled separately. Each component is constrained as a single factor construct.

Thus, each component can be used as a stand-alone measurement tool. The validity and reliability values for three different components are given below.

When Table 2 is examined, factor loads of cognitive attitude vary between .59 and .79. It is seen that the

Table 2. Cognitive attitude reliability and validity values

No	MTK	Factor	Cognitive attitude items
1	0.46	0.794	16. I think I am ecologically literate.
2	0.42	0.771	17. I am knowledgeable about ecological problems.
3	0.53	0.769	29. I make inferences about human behaviors that disrupt the ecological balance.
4	0.41	0.763	15. I know the elements of the concept of ecology.
5	0.32	0.717	28. I have knowledge about the basic principles of ecology.
6	0.41	0.621	26. I develop new ideas for solving an ecological problem.
7	0.45	0.590	27. I offer suggestions for the conscious use of waste.

Explained variance: 52.095%
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.: 0.85
Bartlett's Test of Sphericity $p<.05$
Cranbach's Alpha: 0.84

item-total correlations of the items in the cognitive attitude vary between .32 and .53. The alpha consistency coefficient of the scale is .84. Accordingly, behavioral attitude is a single factor structure and the scale explains 52.1%.

When Table 3 is examined, factor loads of affective attitude vary between .51 and .74. It is seen that the item-total correlations of the items in the affective attitude vary between .31 and .50. The alpha consistency coefficient of the scale is .87. Accordingly, behavioral attitude is a single factor structure and the scale explains 40.67%.

When Table 4 is examined, factor loads of behavioral attitudes vary between .39 and .67. It is seen that the item-total correlations of the items in the behavioral attitude vary between .59 and .76. The alpha consistency coefficient of the scale is .92. Accordingly, behavioral attitude is a single factor structure and the scale explains 50.1%.

In the correlation test conducted to determine the relationship between cognitive, affective and behavioral attitudes, which are the components of ecological literacy, it is seen that there are moderately positive and significant relationships between the components of cognitive and affective attitudes, but there is no significant relationship between the two variables with behavioral attitude. The values obtained are given in Table 5:

As seen in Table 5, the level of relationship between attitudes varies. In this case, as mentioned before, it can be mentioned that there is a moderate positive relationship between affective attitude and cognitive attitude. There is no significant relationship between behavioral attitude and other attitudes.

The first requirement of being ecologically literate individuals is to build ecological literacy on knowledge and attitudes. Ecological literacy begins with knowledge. Then, after environmental knowledge and attitudes are acquired, it turns into a behavioral dimension (Inda, 2008; Davidson, 2010). The aims of the behavioral attitudes of ecological literacy are to gain new skills, make conscious decisions, create active participation in the environment, and enable individuals to communicate effectively with nature. It can be said that behavioral attitude requires a process (Demir, 2021b).

Table 3. Affective attitude reliability and validity values

No	MTK	Factor	Affective attitude items
1	0.35	0.744	9. I am interested in activities in ecology-themed written and visual media.
2	-0.36	-0.725	19. Ecology-themed advertisements and visuals do not interest me.
3	0.50	0.689	8. I am eager to find new solutions to ecological sustainability.
4	0.48	0.683	14. I follow the environmental action strategies in the world with interest.
5	0.37	0.669	32. I have an attitude of protecting ecological diversity.
6	0.34	0.646	29. I am willing to adapt to ecological balance.
7	0.33	0.641	30. I prefer environmentally friendly products during the shopping process.
8	0.31	0.631	10. I care about the ecological environmental activities of Non-Governmental Organizations in the world.
9	0.33	0.621	16. I am aware of ecological diversity.
10	0.34	0.571	22. I appreciate the efforts of Non-Governmental Organizations aiming to preserve the ecological balance.
11	0.34	0.564	21. I complain about the inadequacy of ecology-themed public service ads around the world.
12	0.37	0.555	4. I am concerned about destructive ecological practices in the world.
13	0.43	0.505	3. I appreciate people who are sensitive to ecological issues.

Explained variance: 40.667%
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.: 0.857
Bartlett's Test of Sphericity p<.05
Cranbach's Alpha: 0.87

Table 4. Behavioral attitude reliability and validity values

No	MTK	Factor	Behavioral attitude items
1	0.60	0.439	4. I take care to acquire the necessary skills for ecological acquisitions.
2	0.59	0.419	6. I take a distant approach to products that harm the environment.
3	0.62	0.518	8. I make an effort to follow ecological activities in education systems in the world.
4	0.70	0.592	9. I strive to promote environmentally friendly daily life practices.
5	0.61	0.448	12. I participate in ecologically based organizations around the world.
6	0.60	0.386	13. I share information about developments that increase ecological awareness with my environment.
7	0.59	0.410	19. I strive to preserve the ecosystem.
8	0.60	0.427	20. I participate in the environmental action strategies in the world in the virtual environment.
9	0.62	0.540	21. I produce solutions to prevent artificialization of ecological environments.
10	0.70	0.614	22. I research the effects of unconscious use of natural resources on living life.
11	0.76	0.671	23. I analyze economic activities, their effects on the ecological environment.
12	0.66	0.533	24. I demonstrate how the local government's decisions on the ecological environment affect the ecology.
13	0.59	0.485	28. I search for ways to live in harmony with ecology.
14	0.66	0.538	29. I take an active role in solving ecological problems for a livable world.

Explained variance: 50.136%
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.: 0.920
Bartlett's Test of Sphericity p<.05
Cranbach's Alpha: 0.92

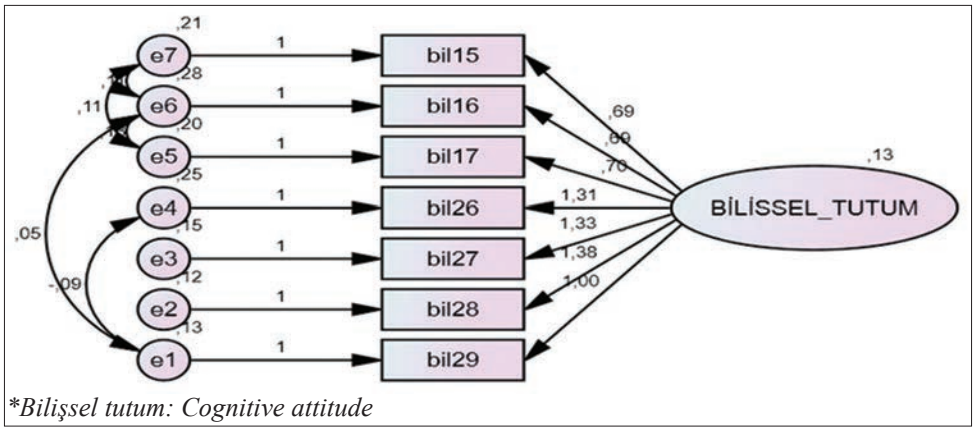

Figure 1. Load values of the model as a result of confirmatory factor analysis of cognitive attitude

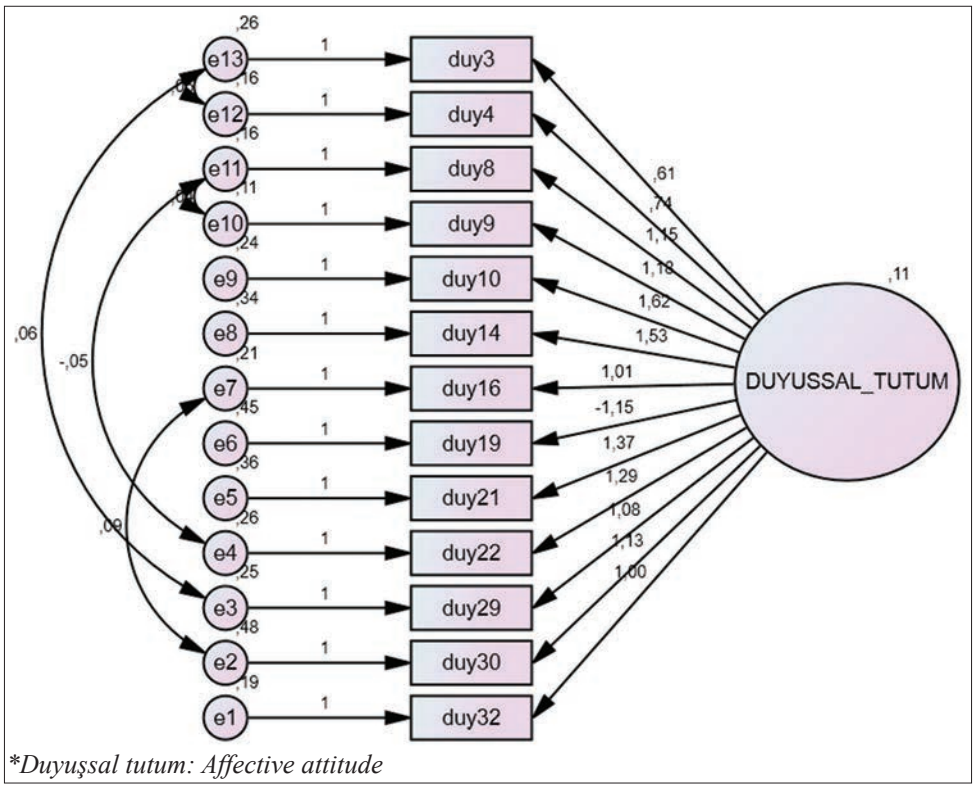

Figure 2. Load values of the model as a result of confirmatory factor analysis of affective attitude

Table 5. Correlation situations between ecological literacy components

Ecological Literacy Attitudes	Correlation Between Attitudes		
	Sensory	Cognitive	Behavioral
Affective Attitude	1.000	0.537	-0.072
Cognitive Attitude	0.537	1.000	-0.079
Behavioral Attitude	-0.072	-0.079	1.000

Another method for construct validity of the measurement tool is Confirmatory Factor Analysis (CFA). Confirmatory Factor Analysis was performed to determine whether the factor structure found in the exploratory factor analysis was confirmed or not. Chi-Square Fit Test for DFA performed in this study, comparative fit index (CFI), normed fit index (NFI), goodness fit index (GFI), adjusted goodness fit index (AGFI), excess fit index (IFI), mean of estimation errors. root square (RMSEA) and standardized root mean square error (SRMR) fit indices were examined. For RMSEA, values of.08 and below indicate good fit, and values between.08 and.10 indicate poor fit (Hooper et al., 2008). For the GFI, CFI, NFI, and IFI indices, 0.90 indicates acceptable fit and 0.95 indicates perfect fit (Bentler & Bonett, 1980; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). For AGFI.,85 is an acceptable fit and.90 is a good fit; For SRMR, values of 0.05 are good fit and values between 0.05 and 0.10 are acceptable; For X^2/SD, 2 and below indicate good fit, and 2 to 3 show acceptable fit (Schermelleh-Engel et al., 2003). Accordingly, it can be said that the three models we established fit well. The factor loadings of the models in which each of the cognitive, affective and behavioral attitudes are handled separately are shown in Figures 1, 2 and 3.

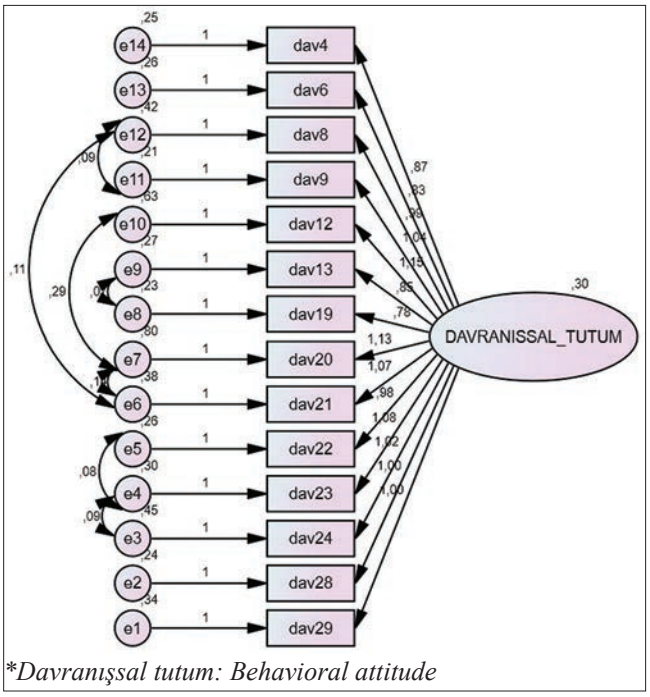

Figure 3. Load values of the model as a result of confirmatory factor analysis of behavioral attitude

The fit indices of the hand model were examined in the CFA on cognitive attitude, and the Chi-square value (X^2=69.13, N=479, *SD*= 21, *p*=.000) was found to be significant. The fit index values are *RMSEA; 0.060, GFI; 0.98, AGFI; 0.96, CFI; 0.99, IFI; 0.99, NFI; 0.98; It was found that ⍺2/df = 2.72.*

The fit indices of the hand model were examined in CFA on affective attitude, and the Chi-square value (X^2=290.72, N=479, *SD*= 31, *p*=.000) was found to be significant. The fit index values are RMSEA; 0.090, GFI; 0.92, AGFI; 0.88, CFI; 0.90, IFI; 0.90, NFI; 0.88; It was found that ⍺2/df = 4.85.

The fit indices of the hand model were examined in the CFA on behavioral attitude, and the Chi-square value (X^2=343.23, N=479, *SD*= 70, *p*=.000) was found to be significant. The fit index values are RMSEA; 0.090, GFI; 0.90, AGFI; 0.86, CFI; 0.92, IFI; 0.93, NFI; 0.91; It was found that ⍺2/df = 4.90.

CONCLUSION AND SUGGESTIONS

In the study, it was aimed to develop an "Ecological Literacy Scale". For this purpose, the validity and reliability studies of the scale were carried out in the research conducted with the participation of teachers working in public schools in Turkey. The final version of the scale consists of 34 items in total, 7 of which are related to cognitive attitude dimension, 13 to affective attitude dimension, and 14 to behavioral attitude dimension. The scale follows a 5-point Likert rating where "1: Strongly Agree", "2: Agree Mostly", "3: Agree Moderately", "4: Agree Slightly" and "5: Agree Strongly". The highest score that can be obtained from the scale was determined as 170 and the lowest score as 34. A high score for each scale shows a high level of the respective dimension, while a high total score indicates a high level of ecological literacy. The total variance explained by the cognitive attitude dimension of the scale was 52.09% and the reliability coefficient (α) was .84; The total variance explained by the affective attitude dimension was 40.66% and the reliability coefficient (α) was .87, and the total variance explained by the behavioral attitude dimension was 50.13% and the reliability coefficient (α) was .92. In addition, as a result of the confirmatory factor analysis carried out regarding the structure of the scale, the fit indices of the model were examined and the Chi-square value (X^2=69.13, N=479, *SD*= 21, *p*=.000) was found to be significant. The fit index values (RMSEA, GFI, AGFI, CFI, IFI, NFI, ⍺2/df) were found to be within acceptable limits. Considering the analyses conducted to test the construct validity and reliability of the scale, it was decided that the data collection tool made a valid and reliable measurement. According to these features, it is understood that the scale has valid and reliable features and can be used to determine the ecological literacy levels of teachers. In addition, by using this developed scale, problems arising from the teacher can be identified and relevant solutions can be developed in order to increase awareness about ecological literacy in educational institutions and learning environments.

REFERENCES

Bentler, P. M., & Bonett, D. G. (1980). Significance Tests and Goodness of Fit in the Analysis of Covariance Structures. *Psychological Bulletin, 88*(3), 588-606.

Berkowitz, A. R., Ford, M. E., & Brewer, C.A. (2005). A framework for integrating ecological literacy, civics literacy, and environmental citizenship in environmental education. In E. A. Johnson & M. J. Mappin (Eds.), *Environmental education or advocacy: perspectives of ecology and education in environmental education* (pp. 227–265). Cambridge University Press.

Boehnert, J. (2013). *Ecological literacy in design education: A foundation for sustainable design.* I. J. B. Reitan, P. Lloyd, E. Bohemia, L. M. Nielsen, I Digranes & E. Lutnæs (Red.), Design Learning for Tomorrow. Design Education from Kindergarten to PhD. Proceedings from the 2nd International Conference for Design Education Researchers vol. 1. (pp. 442-457). Oslo: ABM-media.

Borden, D. S. (2007). *Collegiate ecological literacy requirements: A case study of Western State College of Colorado* [Unpublished master's dissertation]. Prescott College.

Büyüköztürk, S. (2002). *Manual of data analysis for social sciences.* Pegem Publishing.

Casper, A. M. A., & Balgopal, M. M.(2018). Conceptual change in natural resource management students' ecological literacy, *Environmental Education Research, 24*(8), 1159-1176.

Comfrey, A. L., & Lee, H. B. (1992). *A First course in factor analysis*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Curthoys L. P., & Cuthbertson B. (2002). Listening to the landscape: Interpretive planning for ecological literacy. *Canadian Journal of Environmental Education, 7*(2), 224–240.

Cutter Mackenzie, A., & Smith, R. (2003). Ecological literacy: The 'missing paradigm' in environmental education (part one), *Environmental Education Research, 9*(4), 497-524.

Çetin, O., & Yalçınkaya, E. (2018). A Study on developing a scale for environmental awareness. *International Journal of Social Sciences Education*, *4*(1), 14–26.

Davidson, M. F. (2010). E*cological literacy evaluation of the university of Iceland faculty, students, and staff; ımplications for a university sustainability Policy* [Unpublished master's dissertation]. University of Iceland.

Demir, F. B. (2021a). *Ecological literacy skills in education*. E.Koçoğlu (Ed.), Literacy Skills in Education II. Pegem Academy.

Demir, F. B. (2021b). *Investigation of the effect of argumentation-based science learning approach on 6th grade students' ecological literacy* [Unpublished doctoral dissertation]. Kastamonu University.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *The Electronic Journal of Business Research Methods, 6*(1), 53 – 60.

Hu, L., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Inda, K. A. (2008). *Encouraging the Development of Ecological Literacy in K-12 Schools* [0Unpublished master dissertation]. State University.

Jordan, R., F. Singer, Vaughan, J., & Berkowitz, A. (2009). What should every citizen know about ecology?. *Frontiers in Ecology and the Environment, 7*, 495–500.

Koçoğlu, E., & Demir, F. B. (2021). Examples and comparisons from social studies textbooks in Türkiye and other countries. V. Aktepe, M. Gündüz, N. Kurtdede Fidan & E. Yalçınkaya (Ed.), *Social studies teaching from theory to practice* (pp.234-255). Pegem Academy.

Koçoğlu, E., & Egüz, S. (2019). Problematic determinations of field educators regarding social studies education in Turkey. *Manas Journal of Social Studies, 8*(1/1), 27-38.

Lebo III, N. F. (2012). *Toward ecological literacy: A permaculture approach to junior secondary science* [Unpublished doctoral dissertation]. University of Waikato.

Mcbride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. (2013). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here?. *Ecosphere, 4*(5), 1-20.

Megat Jiwa, R. A., & Esa, N. (2013). *Ecological literacy among secondary school students*. CoSMEd 2013 5th International Conference on Science and Mathematics Education 11-14 November 2013, At Penang.

Orr, D. W. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Albany: State University of New York Press.

Osborne, J. W., & Costello, A. B. (2004). Sample size and subject to item ratio in principal components analysis. *Practical Assessment, Research & Evaluation*, *9*(11).

Özdemir, O. (2016). *Ecological literacy and environmental education*. Pegem Academy Publications.

Pitman, S. D., & Daniels, C. B. (2016). Quantifying ecological literacy in an adult western community: The Development and application of a new assessment tool and community standard. *PLoS ONE 11*(3), 1-18.

Puk, T. (2012). The influence of neurobiology on lifelong ecological literacy and ecological consciousness. *International Journal of Environmental & Science Education, 7*(1), 3-18.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the Fit of Structural Equation Models: Tests of Significance and Descriptive Goodness-of-Fit Measures. *Methods of Psychological Research Online*, *8*(2), 23-74.

Schwartz, E. G. (1999). Exploring children's picture books througth ecofeminist literacy. In Gregory A. Smith & Dilafruz R. Williams (Eds.), *Ecological Education in Action: On weaving education, culture, and the environment* (pp. 103-116). New York Press.

Tavşancıl, E. (2018). *Measuring attitudes and data analysis with SPSS* (6th ed.). Nobel Publishing.

TFCEAC (Turkish Foundation for Combating Erosion, Afforestation and Conservation of Natural Assets). (2019). We cultivate hope. Retrieved from: http://www.tema.org.tr on 29.03.2023.

Wooltorton, S. (2006). Ecological literacy: "Basic" for a sustainable future. In Proceedings of the Social Educator's Association of Australia (SEEAA) national biennial conference. Brisbane.

Yalçınkaya, E. (2012). Environmental problems awareness levels of primary school 6th grade students. *Marmara Journal of Geography*, *25*(25), 137–151.

Yurdugül, H. (2013). *Some details for scale development studies in behavioral sciences*. Retrieved on 29.03.2023 from: http://yunus.hacettepe.edu.tr/~yurtgul/3/indir/FA_OrneklemGenisliği