


## Article

# How Important Is Future Teachers' "Connectedness to Nature"? Adaptation and Validation of the Connectedness to Nature Scale

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**Abstract:** The teacher plays a key role in fostering sustainability and implementing Education for Sustainable Development at school. This paper presents a study aimed at adapting and validating a shorter version of the Connectedness to Nature Scale (CNS) to measure student future teachers' connectedness to nature. The scale has been translated into Croatian in an abbreviated form and applied to a specific sample of students from the Faculty of Teacher Education in Rijeka, Croatia (N = 138). One of the tasks was to examine whether there are statistically significant differences among students regarding their membership in eco-associations and previous participation in an Environmental Education/Education for Sustainable Development (EE/ESD) course. A special research objective was to determine the extent to which the current education and membership in an eco-association explain the connectedness to nature. In addition to the indicated research limitations, the results confirmed the significant measured characteristics of the scale. Education has so far proved to be a predictor of connectedness to nature. Additionally, the results showed that membership in an eco-association is a predictor of connectedness to nature. Based on the obtained results, it is possible to conclude that the connectedness to nature must be further explored, especially in the context of the initial education of future teachers, as a possible prerequisite for a successful practice of Education for Sustainable Development in schools.

**Keywords:** connectedness to nature (CN); education for sustainable development (ESD); emotions; eco-membership; teachers



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## 1. Introduction

Teachers' attitudes, opinions, competences, but especially personality traits such as emotions are significantly related to their teaching styles and attitude towards children and school practice in general, as evidenced by numerous studies [1,2]. Emotions and personality traits are related to their pro-ecological attitudes and attitudes towards environmental issues [3]. Experience and emotional attitude towards nature can be a prerequisite for developing pro-ecological attitudes and behaviors [4]. For this reason, in this paper, we present preliminary research that validated the scale that measures the connectedness to nature [1]. In doing so, connectedness to nature is understood as a measure of the emotional connection between an individual or self and the environment. Connectedness to nature is the subject of research and reflection in many disciplines, especially psychology and pedagogy, and is extremely important in future teachers' education. Why? Teachers are often role models for their students. Through their work practice, teachers can encourage a more significant connectedness to nature in their students and thus lay a significant foundation for further development of environmental knowledge, attitudes, and, ultimately, behavior [5].

Furthermore, "A teacher cannot expect environmentally responsible behavior from his students if he does not practice it himself." [6] cited in [7] (p. 19). Study programs or course contents that encourage attitudes towards nature and the environment and critical reflection

on environmental issues and sustainable development can be a significant factor in arousing emotions, encouraging positive attitudes towards nature, and forming the foundation for developing sustainable behaviors [8]. This is evidenced by the results of significant research and the fact that positive attitudes should be encouraged as early as possible in education, already from an early age [9]. Therefore, encouraging this connectedness, i.e., the experience of nature during initial teacher education, is vital.

As far as we are aware, such research has not been carried out at Faculties of Teacher Education in the Republic of Croatia. This research is related to environmental sensitivity issues and fulfilling educational demands based on the New Curricular Reform and New Curriculas in Croatia. Even some similar studies have been conducted, some of which are mentioned in the discussion; however, they do not include the CNS or the measurements of students' similar emotional relationships with nature. In these ways, we are trying to open a new scientific field of research and discussion in Croatia. By adapting and validating the instrument presented in this paper in the Croatian language, we could enhance new research of this field and emphasize the importance of educating student-teachers and developing their sensitivity for nature. For this reason, this paper presents preliminary research with the intention of thinking in a proactive way that would actualize the need to review teacher education and respect for the importance of emotions and experiences of nature as a prerequisite for better initial education and professional development in the field of environment and sustainable development.

## 2. Measuring Connectedness to Nature

The notion of "Connectedness to Nature" originates from the field of environmental psychology. However, its implications place it in the focus of pedagogical considerations as well, as a foundation for continuous educational work within the system of early and preschool, primary, and university education. Connectedness to nature is most often defined as the emotional relationship between an individual and nature, and emotions are often mediators of ecological knowledge and behavior. Goleman, Bennett, and Barlow [10] particularly emphasized the importance of emotions and defined eco-literacy as the integration of "emotional, social, and ecological intelligence" [10] (p. 10). The authors also point out that socially and emotionally engaged eco-literacy includes "Developing empathy for all forms of life, embracing sustainability as a community practice, making the invisible visible, anticipating unintended consequences, and understanding how nature sustains life" [10] (p. 10). Connectedness to nature is also a broader concept than the emotional because it includes an understanding of nature and everything that makes it and refers to caring for the environment [11].

According to previous research [11–13], an essential characteristic of connectedness to nature is temporal stability. In other words, it represents a stable "measure" that can be changed. The possibility of strengthening it is reflected through intensive and continuous interventions and education, especially related to direct experiences, and contact with nature, such as staying in the woods, visiting parks, taking a walk in the fresh air, and the like.

Connectedness to nature is also defined as a psychological term that comprises cognitive, affective, and psychomotor components, whereby all three components should be represented in the connectedness to nature [14].

In terms of measuring a person's relationship to nature, we discuss several instruments that have been successfully constructed and applied so far. Salazar, Kunkle and Monroe [15] summarized all the constructed scales for measuring the connectedness nature in the last 20 years in a publication entitled "Practitioner Guide to Assessing Connection to Nature." The authors provide an overview of 10 key instruments entitled "Tools to measure connection to nature," including a description of the instrument, its measurement characteristics, and examples of research where they have been applied/constructed or modified [15]. In addition to the presented instrument, there are detailed explanations of how to use them, including their validation, modifications, long or short versions, and

examples of different samples, adults, and children. At the beginning of the manual, a draft instrument in relation to age is presented, entitled “Decision Tree: Finding the right tool,” which suggests to the reader the choice of measuring instruments and how to apply them. The authors approached this topic very analytically. With such a detailed presentation of the instruments, they provided a general overview of the literature and significant research ventures in developing adequate instruments for measuring the connectedness to nature. This endeavor has granted this publication with additional value, whose practical importance is reflected in the fact that, in this form, it is intended not only for researchers and scientists but also for practitioners, preschool staff, schools, and universities.

As the New Sustainable Development Curricula has been made as mandatory in primary schools in Croatia and the New Curricula reform has initiated a numerous change, including initial education of teachers [16], we decided to conduct a research among student teachers. Guided by the fact that the instrument by [1] or [12] can be applied to a sample of children and adults, it was decided that this instrument would be used in our research. Therefore, this research is preliminary and is ultimately intended for the application of the instrument in the research that will be conducted on a sample of children/pupils, teachers, and parents in 2021 as part of the project “Connectedness to nature, free-time organization of young school children and digital technology” (2019–2022), carried out at the Faculty of Teacher Education, University of Rijeka, Croatia.

### 3. Literature Review and Research Context

In this research, we started from the assumption that education can, if it systematically encourages value changes, attitudes, personal norms, a sense of responsibility, intelligence, among others [17] (p. 81), also be a predictor of significant connectedness to nature. When referring to the students enrolled at Faculties of Teacher Education, it is expected that their results will be significantly above the mean value regarding the results of the connectedness to nature. We based our arguments for this assumption on a current literature, and research review that confirmed that student-teachers often have high assessments in environmental awareness, attitudes, and behavior [2,3,6,18–20]. Additionally, there are mandatory courses in the initial education of teachers related to ESD. At the Faculty of Teacher Education in Rijeka, there is a mandatory course, Pedagogy of Sustainable Development. Additionally, connectedness to nature, as an emotional relationship between an individual or self and nature, is often linked to or considered to be an important variable, mediator, moderator, or predictor of ecological intelligence, attitudes, values, and/or behaviors [1,4,11,12,21,22].

In their research, [12] emphasize that knowledge of the environment leads to a greater connectedness to nature. One of their research aims was to determine the difference between the students attending studies where ecology and environmental subjects are represented and those students attending studies in mathematics, psychology, and chemistry. In the original study, the CNS scale consisted of 14 variables [12]. The test rated their agreement on a five-point Likert scale, with 1 referring to complete agreement and 5 to complete disagreement. The authors hypothesized that the students enrolled in studies where ecology and environmental subjects are represented would be more connected to nature than the students attending studies in mathematics, psychology, and chemistry. The conducted research confirmed the set hypothesis, and the authors concluded that the students who attend courses related to the environment and environmental issues are more connected to nature [23].

A similar study was conducted by [8]. The author aimed to determine the impact of an introductory course in ecology on university students and their connectedness to nature. The ecology course entitled (BiSci 3) was structured into three thematic units: awakening a sense of connectedness to planet Earth, honestly dealing with the seriousness of the current ecological crisis, and encouraging personal and planetary transformation [8]. For the research, the author used the instrument Nature Relatedness Scale by [11] and included the participants’ interviews in the research. The research results indicated a significant connection between education, i.e., the BiSci 3 course, and the connectedness to nature. The

research results confirmed that the students who achieved higher results on the scale also achieved higher results during the course, i.e., expressed a higher degree of connectedness to nature [8].

Research by [24] and conducted on 12 environmentally conscious faculty members supported previous findings. This research has found that childhood experiences (including education) in nature were important for the formation of a bond with nature that lasts until adulthood, as cited in [25] (p. 3).

In addition to the results of previous research, the hypotheses set out in this study are based on the following arguments.

First, the numerous competence frameworks and models developed so far for the education or professional development of teachers, especially teachers in the field of education for sustainable development, emphasize the importance of emotions and emotional competences.

One such example is “Competences for ESD (Education for Sustainable Development). A framework to integrate ESD into the curriculum of teacher training institutes” [26], which, in its model, also contains an emotional component. Within the model itself, the competences related to emotion include the definition of empathy, emotional attachment, interconnectedness, and a list of teacher competences that include emotions. Competences related to emotions are determined in relation to teachers as individuals (reflection), the teacher in the educational institution—teaching/communication, and the teacher in society [26] (pp. 67–68). In the second model of UNCE Competences in Education for Sustainable Development—Learning for the Future [27], emotions are not explicitly emphasized. However, within the four definitions of competences that are defined as lifelong, a strong involvement of both the emotional/affective and cognitive components, as well as the pillars of lifelong learning, is noticeable: (a) Learning to know refers to understanding the challenges facing society both locally and globally and the potential role of educators and learners (The educator understands . . . ); (b) Learning to do refers to developing practical skills and action competence in relation to education for sustainable development (The educator is able to . . . ); (c) Learning to live together contributes to the development of partnerships and an appreciation of interdependence, pluralism, mutual understanding and peace (The educator works with others in ways that . . . ); (d) Learning to be addresses the development of one’s personal attributes and ability to act with greater autonomy, judgment and personal responsibility in relation to sustainable development (The educator is someone who . . . ) [27].

Second, teacher education programs, especially at the University of Rijeka, contain mandatory courses related to EE/ESD.

Third, the current curriculum from 2006, created by the Ministry of Science and Education, contains the area of environmental protection and sustainable development as integral content, i.e., a cross-curricular topic.

Fourth, the eco-school movement, the international school program in the Republic of Croatia, has been significantly developed, and the National Coordinator of Eco-Schools in the Republic of Croatia is the Association “Lijepa Naša”.

Finally, the New Curricular Reform in the Republic of Croatia has resulted in curricula of the so-called cross-curricular topics, one of which is the Curriculum for Sustainable Development. Until 2019, this topic was considered as an integrated part of the Old Curriculum and entirely dependent on teachers’ sensitivity, motivation, and competence. The Sustainable Development Curriculum [16] was introduced as one of seven cross-curricular topics. It is based on educational expectations, classified into five cycles. The first cycle refers to the 1st through 3rd grade, the second cycle to the 4th through 6th grade, the third to the 6th through 8th grade, and the 4th through 5th cycles refer to the high school level. It is characteristic of all interdisciplinary topic curricula that they are not evaluated at the end of the year but by cycles. In other words, the expectations of cross-curricular topics are planned and implemented in teaching, but their realization is evaluated only at the end of each cycle. The very concept of sustainable development is presented in the curricula

through three dimensions: environmental, economic, and social. It contains three domains: “Connectivity, Action, and Well-being, which act as an integrated whole. Connectivity provides an answer to the question What? Action to the question How? and Well-being to the question Why?” [16]. According to the official decision of the Ministry, all seven topics, including The Sustainable Development Curriculum, are mandatory for implementation in all primary and secondary schools, and it is expected that teachers will implement it through various forms of teaching and learning. Along with the recommendations in implementing sustainable development topics, specific content that should be implemented with children is clearly indicated, such as eco-projects, recycling, school gardens, healthy food, pollution, etc. It follows that the critical determinant of this curricula is the teacher, their competences, and their education and professional development that make them competent to implement that curricula.

#### 4. Materials and Methods

##### 4.1. Research Aim, Tasks, and Hypotheses

This research aimed to adapt and validate the short version of [1] Connectedness to Nature Scale (CNS) and determine the level of connectedness to nature among teacher education students. The task included the following:

1. To determine the measuring characteristics of the instrument Connectedness to Nature Scale.
2. To determine teacher education students’ connectedness to nature measured on the Connectedness to Nature Scale.
3. To determine whether there is a correlation between connectedness to nature, previous education of students, and the students’ membership in an eco-association.
4. To determine the statistical significance of the difference between the students who participated in a previous education/course and those who did not, and in relation to their membership in an eco-association and connectedness to nature.
5. To determine the extent to which the previous education/course has contributed to teacher education students’ connectedness to nature.
6. To determine the degree to which the assessment of connectedness to nature contributes to activism in terms of the membership in an eco-association among the students of the Faculty of Teacher Education in Rijeka.

Given the fact that there is no research on this topic in terms of using the CNS in Croatia, the following hypotheses were set:

1. Good measurement characteristics of the CN Scale (index of measurement of the connectedness to nature) were expected.
2. High arithmetic mean values in teacher education students were expected.
3. Significant correlations between previous education, membership in an eco-association, and the connectedness to nature were expected.
4. It was expected that there would be statistically significant differences between groups of students who have attended courses on environmental issues/an ESD course and those who have not, and the students who are members of an eco-association and those who are not with regard to the assessed connectedness to nature. It was also expected that the students who have participated in a course related to environmental issues/an ESD course and who are members of an eco-association would show statistically more significant results in the assessed connectedness to nature than the groups of participants who have not participated in such a course and are not members of an eco-association.
5. It was expected that the current education or participation in courses related to environmental issues/an ESD course would explain a part of the variance or contribution of connectedness to nature and that the connectedness to nature would explain student activism in terms of teachers’ membership in eco-associations.

#### 4.2. Participants

This preliminary research, which includes the instrument's validation and adaptation, includes a convenient sample of students from the Faculty of Teacher Education in Rijeka, University of Rijeka, Croatia (N = 138). The participants' socio-demographic characteristics were collected: chronological age, year of study, place of residence (countryside/city), membership in an eco-association, and previous education. The participants' socio-demographic characteristics are presented in Table 1.

**Table 1.** Socio-demographic characteristics of participants—student teachers.

Participants	N	M	SD	Age Range	
Chronological age	138	21.71	1.83	19–27	
Year of study	First year	Second year	Third year	Fourth year	Fifth year
N	26	29	21	25	37
Place of residence	Countryside	City			
N	77	61			
Membership in an eco-association	Yes	No			
N	7	131			
Previous education attending EE/ESD course	Yes	No			
N	85	53			

N = number of participants.

The participants' average chronological age is (M = 21.71; SD = 1.83), ranging from 19 to 27 years. The sample includes participants enrolled in the first (N = 26), second (N = 29), third (N = 21), fourth (N = 25), and fifth (N = 37) year of studies. Of the total number (N = 138) of participants, (N = 77) participants live in the countryside, while (N = 61) live in the city. Only seven participants are members of an eco-association. There are (N = 85) participants who have participated in a course related to environmental issues/sustainable development in their previous university education and (N = 53) of those who have not. The Faculty of Teacher Education in Rijeka are mostly female students, which is a limitation regarding the sample, and there is imbalance in the sample regarding other sociodemographic characteristics of the participants. However, as it was stated before, this is only preliminary research with the main goal to adapt and validate the instrument in the Croatian language, and any further use of this instrument must include a more balanced, representative, and larger sample.

#### 4.3. Measurement Instruments and Procedures

The research was conducted using a survey. The measuring instrument was a survey questionnaire that contained three additional questions in addition to the socio-demographic characteristics. The first question was whether the participants were members of an eco-association, alliance, or group, to which the participants provided a "yes" or "no" answer. The second question referred to previous education, i.e., whether the participants had participated in a course related to environmental contents/an ESD course during their previous education, to which the participants provided a "yes" or "no" answer. The third question was a short version of [1]. The scale comprised 10 items with which the students' connectedness to nature was examined, and the participants had to circle their (self-assessed) agreement with the statements ranging from 1 (strongly disagree) to 7 (strongly agree). The research was conducted in April and May 2020 to prepare the thesis by [23] entitled "Connectedness to nature of students enrolled in the Integrated Undergraduate and Graduate Studies of Teacher Education in Rijeka" (2020). The research was conducted following the ethical principles of conducting research, with obtained faculty consent. The survey was anonymous and voluntary.

## 5. Results

The first research task was related to the adaptation and validation of the Connectedness to Nature Scale, abbreviated scale [1]. The original, longer version of the scale [12] contained 14 items, and during the adaptation of the items, it was decided that the scale would contain 10 items due to the intelligibility and translation of the items. Therefore, in the following, all analyses were performed on 10 items [1]. The scale was translated with the help of an official lecturer into Croatian, then into English (translation and back-translation for accuracy). A survey was conducted on a sample of students from the Faculty of Teacher Education in Rijeka, University of Rijeka, Croatia (N = 138). The characteristics of the measurement instrument are presented relating to validity and reliability. The measurement of the internal consistency of the instrument through the Cronbach's alpha coefficient was used as reliability criteria. Structural, construct, and convergent validity was measured using factor analysis measures (eigen values, factor loading, variance explanation) and related tests such as the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity (equal variance) as a measurement of sample adequacy for Exploratory (EFA) and Confirmation factor analysis (CFA).

The preliminary tests results indicated that the distribution of the whole scale results in the sample deviated from normal (K-S  $d = 0.13147$ ,  $p < 0.05$ ; Lilliefors  $p < 0.01$ ; Shapiro–Wilk  $W = 0.93351$ ,  $p = 0.00000$ ). Therefore, non-parametric tests or substitutions for parametric tests were performed below: Spearman's rho-test for correlations and Mann–Whitney U-test for testing differences between the participants.

The reliability analysis of the whole CNS indicated that Cronbach's alpha value is high and acceptable, i.e., on 10 items, it is  $\alpha = 0.83$  ( $\alpha = 0.92$  with reverse items 4 and 10), which is a very satisfactory result.

Furthermore, an exploratory principal component analysis was performed. The results indicated the following adequate values: Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) = 0.89 and Bartlett's Test of Sphericity of  $\chi^2 = 970.911$  (45),  $p = 0.000$ . Acceptable KMO values were above 0.60, and a statistically significant Bartlett's Test of Sphericity indicated sample adequacy, regardless of the smaller number of participants.

In line with [12] previous research and guidance, it was necessary to force one factor. An exploratory factor analysis (EFA) was performed, and one factor was obtained (6.037 and an explanation of 60% of the variance). The confirmatory analysis (CA) of maximum likelihood was performed below with an eigenvalue of 5.672 and an explanation of 56% of the variance. Table 2 depicts the factor matrix.

**Table 2.** Factor (structure) matrix and factor loadings for CNS, maximum likelihood method; descriptive parameters Mean (M), Standard Deviations (SD), Skewness, and Kurtosis.

Factor (Structure) Matrix	Descriptive Parameters				
	Factor 1	M	SD	Skewness	Kurtosis
Connectedness to Nature Scale (CNS)					
1. I often feel a strong connection to nature.	0.752	5.43	1.409	−0.699	−0.094
2. I think of nature as a family that I belong in.	0.805	5.25	1.469	−0.758	0.156
3. I see myself as a part of the greater circle of life.	0.738	5.74	1.325	−1.207	1.283
4. Humans are more important than plants and animals. (R) <sup>1</sup>	0.247	5.63	1.172	−0.486	−0.646
5. I feel related to animals and plants.	0.819	5.43	1.445	−0.679	−0.365
6. I feel I belong to the Earth and that the Earth belongs to me.	0.833	5.46	1.466	−0.873	0.149
7. I feel that all living things in this world are connected, and I am a part of that.	0.859	6.05	1.406	−1.756	2.827
8. There is something that every living thing shares.	0.771	6.25	1.195	−1.791	3.078
9. Like the tree in the forest, I feel I belong to nature.	0.879	5.64	1.450	−1.052	0.688
10. I do not feel part of nature. (R)	0.618	6.44	0.920	2.077	4.407

<sup>1</sup> (R) = reverse items according to the author's instructions.

As is observable from the factor matrix, the highest factor loading was obtained on the item “Like the tree in the forest, I feel I belong to nature” and the lowest (below 0.30) on item 4, “Humans are more important than plants and animals.” Item 4 was, therefore, deleted from the scale. A repeated confirmatory analysis on an abbreviated nine-item scale ultimately resulted in a 5.61 eigenvalue and an explanation of 62% of the variance. As can be seen from Table 3, high factor loadings were obtained on all items after deleting item 4 from the scale.

In accordance with the set second task, the mean values of teacher education students’ connectedness to nature were determined. The descriptive values of the whole scale are  $M = 5.74$ ;  $SD = 1.09$ , which we interpret as medium-high and high values, i.e., that the students, overall, assessed their connectedness to nature with high results.

**Table 3.** Factor matrix and factor loadings for CNS after item 4 deletion, maximum likelihood method (sorted by size).

Factor Matrix (CFA) Method: Maximum Likelihood	
	Factor 1
1. Like the tree in the forest, I feel I belong to nature.	0.880
2. I feel that all living things in this world are connected, and I am a part of that.	0.860
3. I feel I belong to the Earth and that the Earth belongs to me.	0.834
4. I feel related to animals and plants.	0.819
5. I think of nature as a family that I belong in.	0.804
6. There is something that every living thing shares.	0.770
7. I often feel a strong connection to nature.	0.753
8. I see myself as a part of the greater circle of life.	0.739
9. I do not feel part of nature. (R)	0.616

R—reverse item scoring.

The third task was to determine the correlations between the connectedness to nature, participation in a course on environmental issues/an ESD course, and membership in an eco-association. Since there was no normal distribution of results in the sample, Spearman’s rank test ( $\rho$ ) was applied. The results are shown in Table 3.

As can be seen from Table 4, statistically significant, negative, and positive correlations were found between all three variables. It was determined that  $\rho = -0.180$  between the connectedness to nature and previous participation in EE/an ESD course,  $\rho = -0.184$  between the connectedness to nature and the membership in an eco-association, and  $\rho = 0.183$  between previous education and the membership in an eco-association. Additionally, the results suggest that these are weak links.

**Table 4.** Spearman’s analysis results of CNS ( $\rho$ ), participation in EE/an ESD course, and membership in an eco-association.

Correlations Spearman’s Rho	CNS	Participation in EE/an ESD Course	Membership in an Eco-Association
CNS	1		
participation in EE/an ESD course	−0.180 *	1	
membership in an eco-association	−0.184 *	0.183 *	1

\* Correlation is significant at the 0.05 level.

In this sense, this connection was verified with the fourth task, which determined the existence of statistically significant differences between the groups of participants with regard to previous education and membership in an eco-association.

The fourth task was to determine whether there are statistically significant differences between those students who have participated in a course related to environmental issues/an ESD course and those who have not, and among the students who are members of an eco-association, alliance, or a similar group dealing with ecology in relation to their



assessments of connectedness to nature. Non-parametric Mann–Whitney U-tests were performed for independent samples on these variables.

The first part of this task was to determine the differences between the participants in relation to previous education or EE/attended ESD course. The results are shown in Table 5.

**Table 5.** Results of the Mann–Whitney U-test for EE/attended ESD course.

Results for EE/Attended ESD Course	CNS	N	Mean Rank (Mr)	Sum of Ranks
Have You Participated in a Course Related to EE/ESD in Your Previous Education at the Faculty?	yes	85	75.15	6387.50
	no	53	60.44	3203.50
	total	138		
Mann–Whitney U	1772.500			
Wilcoxon W	3203.500			
Z	−2.105			
Asymp. Sig. (2-tailed)	0.035 *			

\* Value is significant at the 0.05 level.

As can be seen from Table 5, statistically significant differences were found between the groups of participants in relation to their previous education/attended EE/ESD course ( $z = -2.105$ ;  $p = 0.035$ ). The participants who had previously participated in EE/ESD courses achieved statistically significantly higher scores ( $Mr = 75.15$ ) than those who had not ( $Mr = 60.44$ ). A weak effect size was also found, which is  $\eta^2 = 0.0309$ , i.e., 3% of the variance can be explained with previous education.

The second part of the task was to determine whether there are statistically significant differences among the participants in terms of their membership in an eco-association. The results are shown in Table 6.

**Table 6.** Results of the Mann–Whitney U-test for membership in an eco-association.

Results for Membership in an Eco-Association	CNS	N	Mean Rank (Mr)	Sum of Ranks
Are You a Member of an Eco-Association?	yes	7	101.14	708.00
	no	131	67.81	8883.00
	total	138	101.14	708.00
Mann–Whitney U	237.000			
Wilcoxon W	8883.000			
Z	−2.153			
Asymp. Sig. (2-tailed)	0.031 *			

\* Value is significant at the 0.05 level.

The results indicate statistically significant differences between groups of participants ( $z = -2.153$ ;  $p = 0.031$ ) in relation to the connectedness to nature. Those participants who are members of an eco-association ( $Mr = 101,14$ ) achieved higher results than those who are not ( $Mr = 67,81$ ) regarding their connectedness to nature. A weak effect size was calculated and obtained, which is  $\eta^2 = 0.033$ , i.e., 3% of the variance can be explained with the membership in an eco-association.

The last or fifth task referred to the assessment of the contribution of previous EE/an ESD course to the explanation of the variance of connectedness to nature measured on the CNS and the degree to which the assessment of the connectedness to nature contributes to students' eco-activism in terms of their membership in eco-associations. Two regression analyses were performed to obtain a clearer picture of the contribution of these variables. In each analysis, we used the enter method of regression analysis.

In the first regression analysis, the criterion variable was the connectedness to nature measurement according to the CNS, and the predictor of the previous education was participation in EE/an ESD course. Those participants who had participated in such a course were coded with (1 = yes, as the reference group), and those who had not participated were coded with (2 = no). The results are shown in Table 7.

**Table 7.** Results of the regression analysis for EE/attended ESD course.

Model CNS Criterion Variable	R	R <sup>2</sup>	F	B	Std. Error	$\beta$	t	Sig.
Constant				6.389	0.277		23.040	0.000
Predictor EE/attended ESD course	0.207	0.043	6.075	−0.466	0.189	−0.207	−2.465	0.015 *

\* Value is significant at the 0.05 level.

The results indicate that there is a statistically significant contribution of previous EE/attended ESD course ( $F(1136) = 6.075; p = 0.015$ ) to the connectedness to nature, which explains the obtained coefficient of  $R^2 = 0.043$ . In other words, 4.3% of the variance of the connectedness to nature was explained. It is a weak effect, but it is statistically significant and maybe indicative for some further research. It was also found that statistically higher results were achieved by those who have attended EE/ESD courses during their previous education ( $B = -0.466$ ).

Finally, a second regression analysis was performed in which the criterion was the variable membership in an eco-association, whereby it was attempted to determine the degree to which (self)assessments of the connectedness to nature explain the membership in eco-associations, i.e., student activism. The results are shown in Table 8.

**Table 8.** Results of the regression analysis for membership in an eco-association.

Model CNS Criterion Variable	R	R <sup>2</sup>	F	B	Std. Error	$\beta$	t	Sig.
Constant				7.313	0.829		8.822	0.000
Predictor Membership in an eco-association	0.161	0.026	3.627	−0.805	0.423	−0.161	−1.904	0.059

As can be seen from Table 8, the obtained result indicates that no statistically significant result was obtained ( $F(1136) = 6.672; p = 0.059$ ). In other words, only the (self)assessment of the connectedness to nature does not explain students' membership in an eco-association ( $p = 0.059$ ). We also must emphasize that in the sample just a few participants ( $N = 7$ ) stated their membership in an eco-association. The previous results of the Mann–Whitney U-test confirmed the statistically significant difference between groups of participants but with very weak effect, so in this sense, this result is logical.

## 6. Discussion

The first task of this research was to examine the instrument's measurement characteristics adapted to the Croatian language, i.e., a short Connectedness to Nature Scale by [1]. By examining the measurement characteristics, very satisfactory validity and reliability measures were obtained. The factor analyses performed (exploratory and confirmatory) also resulted in very satisfactory values, especially after the deletion of one item (item 4 with low loadings). These foundations offer fertile ground for the confirmation of the first hypothesis. The second task determined the descriptive values of the scale, i.e., students' connectedness to nature, and determined medium to high values of arithmetic mean on all items. The third task was to examine whether there is a statistically significant relationship between the CNS, students' membership in an eco-association, and previous education/participation in an ESD/EE course. This hypothesis was also confirmed because statistically significant correlations were found, albeit negative and positive. Of course, it is possible to interpret these results in a way that the participants who are not members of eco-associations and those who have not attended courses on environmental issues/ESD

courses show a lower connectedness to nature. In other words, the assessment of the connectedness to nature decreases in relation to the participants who are not members of an eco-association and who have not attended courses on environmental issues/an ESD course. However, in this research, we did not include some variables that may also influence these results (attitudes, values, etc.). Correlations, but with very weak effects, were found in relation to previous education and membership in an eco-association, which we interpret with caution, but also as positive and indicative results. In the continuation of the research, statistically significant differences were found between the groups of participants in relation to previous education, whereby those who have enrolled or have participated in an EE/ESD course achieve statistically significantly higher results and those participants who are members of eco-associations. Although very weak effects were obtained, the hypotheses of the third and fourth tasks were nevertheless confirmed. Regression analyses determined the contributions of previous participation in EE/ESD courses and the connectedness to nature. This is a weak effect of only 4% of the variance, albeit an indicative one in the sense that the variable of education has some potential for some further research. Hence, this confirms the hypothesis. In relation to the task of determining the degree to which (self)assessment of the connectedness to nature explains the membership in an eco-association of active students, no statistically significant result was obtained ( $p = 0.059$ ). Therefore, this is the only hypothesis that was not confirmed.

As no such research has been conducted in Croatia, it is not possible to make comparisons to similar research. However, at the international level, the results of the student population often confirm the high values of positive attitudes towards sustainable development, especially when it comes to future teachers or student populations [18,28]. When it comes to the interpretation of the obtained results and set hypotheses, there is no reason for dissatisfaction. The scale was adapted and validated; nine items were confirmed, one factor, and a significant explanation of 62% of the total variance, which we interpret as a very successful result. It should also be noted that this scale, albeit in an expanded form, has already been used in previous research, retaining only 11 or 7 [19,20] items after validation, and it also resulted in very satisfactory measurement characteristics.

Regarding the results of the assessed connectedness to nature and correlation calculations and statistically obtained differences and regression analyses, several essential elements should be pointed out. First, there are limitations in this research regarding the sample, which was convenient, not in balance, and comprised mostly female students. Therefore, these results must be accepted with some caution. However, it is preliminary research and presents a base for further explorations. Second, the instrument is adapted and validated in the Croatian language, so in this sense these results are important for further research and possible comparison with other samples and university students from other countries. It should be emphasized that the connectedness to nature includes an emotional component, empathy, feeling and experience of nature, i.e., it implies a certain emotional competence that is important in the field of teacher education and that it is vital to develop it through education. Numerous studies emphasize the importance of personal traits and emotions in teacher education and confirm that the student population, especially in the field of teacher education for sustainable development, achieves significantly high results when it comes to positive emotions (openness, conscientiousness, comfort, altruism) [3,29]. In addition, previous research on environmental attitudes and values in Croatia among the student population, and especially in the education of future teachers, confirms these results [30,31]. The results of this research correspond to some previous research, but also to recent research that indicates a strong link between education and pro-ecological attitudes, values, and behaviors [8,12,31]. Research on eco-activism also points to a similar conclusion. Membership in associations and volunteering are common practices of the student population [32], which certainly require a significant pedagogical approach in terms of engagement and eco-activism and active involvement in contemporary environmental issues and sustainable development. Therefore, the choice of this variable was not random, nor were the variables of previous education. In this

research, only the hypothesis concerning the connectedness to nature as a predictor of eco-membership was not confirmed. Namely, research confirms that both the connectedness to nature and activity can be or are significant variables and contributions or are mediators of ecological identification, pro-ecological attitudes, and pro-ecological behaviors [32–37].

Why is there a significant connectedness to nature among future teachers?

With this research, we have tried to answer the question posed in the title of this paper. Connectedness to nature is of great importance in laying the foundations for the development of children's environmental literacy, pro-environmental attitudes, values, and more sustainable behaviors, especially if there is evidence that field classes in nature, i.e., that experiences in nature contribute to the quality of children's learning [36]. Wilson shares this view that "The best results will be obtained when teachers are able to integrate learning in the natural environment with classroom learning strategies and develop partnerships that ensure the continuity of environmental learning experiences in all aspects of school life," as cited in [38] (p. 4). There is a myriad of teacher's roles in the processes of care and education. The teacher is seen as a role model for their students, a reflective practitioner, mediator, moderator, facilitator, and is required to have a high level of competence [39,40]. Emotions and the ability to convey emotions in the teaching process, as well as the personality traits of future teachers, are part of these competences. The development of these competences during initial teacher education is necessary, especially when it comes to teachers' obligation to implement sustainable development curricula in their teaching practice and achieve the set learning outcomes about sustainability, including the connectedness to nature.

## 7. Conclusions

All but one hypothesis was confirmed in this research. Very satisfactory measurement characteristics of the adapted instrument, medium to high value, were obtained, and it was determined that there are differences among students in the assessment of the connectedness to nature. We determined that with weak effects, students who have previously attended EE/an ESD course and those who are members of eco-associations achieve higher results on the connectedness to nature. Additionally, we determined that previous education (having participated in EE/an ESD course) contributes, albeit with weak effect, to the connectedness to nature, while the connectedness to nature does not explain activism in terms of membership in an eco-association. However, a correlation between education and eco-membership suggests that education could be a significant predictor of activism; however, this was not measured in this research. Related to this are the limitations of this research regarding the sample, which concern the fact that this is preliminary research. It was also carried out on a convenient, specific, and small sample, which was mostly comprised of female students. Therefore, these results must be interpreted with caution. Future research, quantitative as well as qualitative ones, should certainly include a more representative sample, including more diverse gender representation and, of course, a larger sample that includes student-teachers from other faculties in Croatia, that can be compared with other similar research from other countries. Based on the results from this research, we can conclude that it is possible to generate numerous questions including variables that we used in our research. We determined some weak effects and we cannot generate these results but, based on that, we can conclude that there are some indications of correlations between eco-membership and students' previous education and connectedness to nature. There are some questions that could certainly be a point of origin for future research, such as what variables could explain these connections or how to enhance these correlations. The possibilities regarding these correlations should be explored further, including some sociodemographic characteristics of the participants, such as different lifestyles (vegetarians, athletes) and urban and rural living. Qualitative research based on interviews and on thematic analysis should include setting research questions regarding the forms of enjoyment in nature that are available to the students, especially in urban settings, attitudes towards nature regarding the understanding of nature

as a resource, object, recreational setting, or object of beauty and a possible connection to some specific behaviors such as recycling and gardening. It should also include questions regarding the notion and comprehension of eco-activism and involvement in different forms of eco-activism, and what are possibilities of institutions of Higher Education in creating more activities that can enhance student involvement in such activities. An important subject that we could generate from this research is their own competences gained for the education and visions of future practice in ESD, including previous but also current forms of education such as formal, non-formal, or informal that students are using or could use as sources of their understanding of nature and issues regarding EE and ESD. In future qualitative and quantitative research, these links should certainly be explored further. In this sense, future research could give some answers regarding these variables and foundations for more extensive research of the importance of connectedness to nature in students' lives and their initial teacher education.

Finally, it should be noted that the teacher, initial education of teachers, their values, and practice are the main drivers of change in schools and change among the students [6,26,27], Teachers' personality, but also emotions, are a significant part of choosing this profession. Emotions, as well as previous education or competences, are determinants of the teaching style and thus the implementation of curricula, especially when discussing the curricula of Education for Sustainable Development. From that position, in implementing Sustainable Development curricula in school, teachers as role models represent a significant factor in transmitting positive feelings, attitudes, values, and behavior towards and for nature/environment and sustainable development to their students and towards the fulfillment of Sustainable Development Goals 2030 that are set upon us.

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