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# Evaluating an Educational Intervention Designed to Foster Environmental Citizenship among Undergraduate University Students

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**Abstract:** Taking its primary interest in active environmental citizenship, this paper aims at evaluating a case of an educational intervention designed to foster environmental citizenship among undergraduate students at a technological university. The study employs a survey methodology implementing a recently validated environmental citizenship questionnaire. A randomized pre-group –post-group quasi-experimental survey design explores students' environmental citizenship attributes before and after the intervention course, 'Sustainable Development', in comparison to students who participated in a general elective course, 'Media Philosophy'. The results show that the participation in the intervention course induced positive change in students' environmental citizenship in comparison to the control group. Additional analysis indicates that environmental citizenship is significantly related to environmental attitudes, nature experiences during childhood and adolescence, and gender. The article provides a timely contribution shedding light on how specific pedagogical approaches in higher education can foster environmental citizenship.

**Keywords:** environmental citizenship; education for environmental citizenship; pedagogical approaches in environmental education; sustainable development; promoting sustainability in higher education; connectedness to nature; nature experience

## 1. Introduction

### 1.1. Environmental Citizenship in Higher Education

The primary interest of this article is active environmental citizenship (EC) and the ways that it could be achieved through higher education settings. Environmental citizenship, as an idea and area of study, is situated within citizenship theory and reflects the understanding that active involvement in achieving the aspirations of sustainable development and promoting societies committed to sustainability is one of the responsibilities of the citizen. The environment is increasingly being framed as a matter of citizenship and, likewise, citizenship is increasingly being framed to include the environment [1]. A recent conceptualization of EC put forth by the European Network for Environmental Citizenship (ENEC) identifies EC as the active participation of citizens, in the private and public sphere, through individual and collective actions, toward solving current environmental problems and preventing the creation of new ones, parallel to developing a healthy relationship

with nature [2]. The ENEC's conceptualization not only acknowledges the individual's exercise of environmental rights but also acknowledges the responsibilities that derive from other people's environmental rights. Corresponding with Barry's [3] deep perspective of sustainability citizenship, the ENEC's conceptualization of EC emphasizes the capacities and commitment for addressing the structural causes of environmental degradation [3,4].

Despite rich theoretical discourse on EC, mainly by citizenship theoreticians, education for environmental citizenship (EEC) is a relatively novel field of study. It is theoretically related to the concepts of environmental education [5], science education [6], citizenship education [7], and especially education for sustainability [8]. Yet, it has its distinctive features [4], emphasizing collective actions and participation in the role of agents of change as an inherent component of citizenship.

This article pays attention to the ways that EEC could be effectively implemented. It explores the impact of a unique undergraduate sustainable development (SD) course on the students' EC attributes, implementing a recently developed instrument for measuring the dimensions of EC [9]. University students comprise a crucial target audience for EEC due to their anticipated future roles both within citizenry and within work environments [10]. In an increasingly complex, uncertain, and ambiguous world characterized by environmental and social challenges, institutions of higher education have an ethical responsibility to break outdated paradigms and be leaders of change to advance societies who are committed to the principles of sustainability and are equipped to realize the goals of sustainable development [11–13]. Consequently, these institutions have a vital role in developing environmentally literate graduates equipped and empowered with the competences necessary for addressing these challenges—graduates who are committed to and capable of bringing an environmental perspective into their future career and of acting as influential environmental citizens and professionals in society [12,14,15].

Interventions designed within higher education settings are acknowledged as significant facilitators of needed EC transformation. The most often studied designs of interventions have included infrastructure developments [16–18], organizational culture change [19,20], communication campaigns [21], or curriculum integration and pedagogical approaches [22–25]. This study follows the research stream focusing on the curricula and educational approaches for developing SD competences. Relatively few studies have addressed curricular-related or pedagogical-approach-related interventions for cultivating EC, even though these play a crucial role in student's learning [26] (p. 1). Lozano et al. [15] also claim that less research has explored the connection between how courses are delivered and their influence on the development of sustainability competences. Literature also provides empirical grounding for assuming that environmental and social competences that are learned within the context of formal education can foster action taking outside that context, i.e., in the private and public domains [27].

While several studies have investigated the effect of university education on several of the EC attributes [28–30], this study is the first attempt to use the recently validated holistic EC measurement instrument, the Environmental Citizenship Questionnaire (ECQ) [9], in the context of higher education students. This tool addresses competencies associated with EC in the cognitive (knowledge, conceptions, and skills) and affective (attitudes, values) dimensions and engagement in actions associated with EC in both private and public spheres currently and with a future-oriented perspective (likeliness of involvement in the future). In view of the novelty of this tool, in addition to exploring the students' EC attributes, we also conducted various analyses in the aim of exploring the validity of this instrument in the context of higher education (HE) students.

### 1.2. Factors Associated with Environmental Citizenship

The literature indicates that many factors influence individuals' engagement (or lack of) in pro-environmental actions and behaviors [31]. Generally, these can be categorized into demographic factors (e.g., gender); external factors (such as the existence of supportive infrastructure, economic factors, and sociocultural factors); and internal factors

(e.g., cognitive, such as environmental knowledge, affective, such as values and attitudes, awareness, which straddles the cognitive and affective domains, and the locus-of-control and sense of efficacy) [31]. Additionally, research indicates that experiences in nature during childhood are influential for an individual's environmental values and sensitivity [32,33]. This study tapped into the involvement of the demographic variables of gender and nature experiences.

Concerning the influence of background factors on dimensions of environmentalism, despite inconsistencies in the empirical literature, several studies indicate the phenomenon of gender differences, whereby females report more pro-environmental attitudes and greater concern for the environment as compared to men. This has been found with adults [34,35] as well as in youth [34,36–38]. Arnocky and Stroink [35] found that this is mediated by empathy, in line with socialization and gender role theories asserting that females are raised to value and empathize with the needs of others. Females also report greater involvement in pro-environmental behaviors/actions [34] and are more willing to cooperate around environmental resources, while men reported greater competitiveness around ecological resources [35]. On the other hand, boys outperformed girls both in objective environmental knowledge [37] and subjective knowledge of environmental issues [38]. Understanding the relationship between such demographic variables provides valuable information for promoting environmentally oriented individuals/environmentalism.

The literature supports that environmental issues are strongly linked to a disconnect from nature and that developing a sense of connectedness to nature is an important aspect in promoting pro-environmental behavior [39,40]. Positive experiences in the natural environment and creating a sense of place are important for developing positive feelings regarding the environment (e.g., respect, concern, care), and these emotional connections with nature leverage motivating the individual's commitment to the environment and willingness to adopt environmentally responsible behavior [33]. In her review of the research on the connection with nature in childhood, Chawla [33] also reports that young people who had more access to and experience in nature express higher levels of connection to nature, and this extends into adulthood—a greater connection to nature in adults is associated with more access and interaction with nature during childhood.

### 1.3. Environmental Citizenship in the Curriculum at Kaunas University of Technology

This paper investigates a case study from Kaunas University of Technology, Lithuania. Following the United Nations 'Decade of Education for Sustainable Development' [41] and responding to the UN call for 'The Decade of Action and Delivery for Sustainable Development' [42], also in compliance with EU Green Deal targets [43], the Kaunas University of Technology has undergone a major review of the general competences developed through general elective courses. A T-shape model [44,45] of education for sustainable development [46–48], infused with ideas of education for environmental citizenship were taken as conceptual backgrounds. Starting with the 2019–2020 academic year, all first-year university students are entitled to freely choose a general elective course of either "Sustainable Development" or "Media Philosophy". The students enrolled in either of the courses in the Fall semester of 2020 constitute the population of this current research. The intervention case includes participation in the course "Sustainable Development" during that semester.

The intervention course "Sustainable development" aims to develop global, critical, and reflexive awareness of the social, economic, cultural, and environmental contexts in which the graduate will act and an ethical position based on the principles of sustainable development. Thus, the intervention course targets the attributes of environmental citizenship [4] and indicates the competence aspect of the competence-learning-intervention-assessment model (CLIA-model) [26]. The control group course ("Media Philosophy") focused on a critical reflection of media and technology developments, including digital cultures and artificial intelligence.

In terms of learning methods and teaching approach of the CLIA model [26], the intervention case bears the following characteristics: a holistic and multidisciplinary approach; focus on group-work and practical seminars; and active learning methods (elaborated further on). The course content covers social, economic, environmental, and engineering content, with emphasis on the interconnections among the topics. The course is taught by a multidisciplinary team of lecturers, including sociologists, economists, philosophers, and staff with expertise in environmental studies, sustainable design, and civil engineering. The content of the learning materials addresses both national and global contexts (e.g., social welfare and climate impacts). Connections with the past and future are well established through the provision of historical data on development trends and then presenting the megatrends that define the future development scenarios [49]. The course focuses on group-work and practical seminars: this six ECTS course includes only 16 h of lectures, while 48 h are devoted to practical supervised learning, and another 96 h of independent learning. Active learning methods applied during practical supervised learning sessions (seminars) and independent learning included design thinking, role play, problem-based learning, mind-mapping, case study, and socio-scientific inquiry-based learning. These facilitate pluralistic approaches to teaching and learning, recognized by Sinakou et al. [26] as one of the key aspects of education for sustainable development. The fourth element of the CLIA model is assessment. Assessment in the intervention course includes problem-solving tasks, a competency portfolio, reflection on action, as well as midterm and final exams.

The aim of this study was to investigate the effectiveness of this course on developing the students' EC. Toward this end, it compared the changes in EC attributes/variables between the students who participated in the Sustainable Development course and students who participated in the parallel elective Media Philosophy course. Thus, this study provides a response to the shortage identified by Lozano et al. [14,15] of studies exploring the connection between the pedagogical approaches of sustainable development courses in higher education and their influence on developing SD competences. The results of this evaluation contribute insight regarding the effectiveness of a uniquely designed educational intervention conducted as a university-wide general electives course. Thus, this article provides a timely contribution, shedding light on how specific pedagogical approaches can foster EC. Additionally, by employing the environmental citizenship questionnaire (ECQ), it provides a first time implementation of this new tool in the context of higher education and contributes to exploring the validity of this tool in different contexts.

## 2. Research Questions and Hypotheses

To address the influence of the above-described intervention on the environmental citizenship attributes of the participating students, we put forward the following four interconnected research questions:

**RQ1.** Is the ECQ a reliable and valid instrument for measuring HE students' EC?

**RQ2.** What are the EC characteristics of first year undergraduate students in a large technical Lithuanian university?

**RQ3.** How do the EC characteristics correlate with background variables such as gender and nature experience?

**RQ4.** What is the impact of students' participation in a general elective course 'Sustainable development' on their environmental citizenship?

The research questions together build up to test the overall hypothesis of the current study: the general elective course focusing explicitly on sustainable development (by implementing it through learner-oriented pedagogical methods identified as effective in developing SD competences) will foster increased EC in participating students. To test this, we conducted a quasi-experimental, randomized, pre–post group design to compare the EC variables between students participating in the SD course and students participating in the media philosophy course. The students in this design belong to one of four groups: the Pre-Intervention Group (PIG), the Pre-Control Group (PCG), the Waiting (post) intervention group (WIG), and the Waiting Control Group (WCG), allowing us to isolate the effect of the

intervention. The groups are defined based on (a) the students' choice of one of two general elective courses: either 'sustainable development' or 'media philosophy'; and (b) a random split-group assignment of students that participate in the questionnaire either before their course had started or after their course had ended. To test RQ4, four specific hypotheses were put forward. If all four hypotheses are confirmed, the effect of the intervention course can be considered significant.

**Hypothesis 1 (H1).** *Students that were assigned to either one of the two groups that took part in the survey before the courses took place (PIG, PCG) show similar levels of EC.*

**Hypothesis 2 (H2).** *Students that were assigned to either one the two groups connected to the control group (PCG, WCG) show similar levels of EC.*

**Hypothesis 3 (H3).** *Students that were assigned to the group that took part in the survey after the intervention course took place (WIG) report higher levels of EC than the students assigned to the pre-intervention group (PIG).*

**Hypothesis 4 (H4).** *Students that were assigned to the group that took part in the survey after the intervention course took place (WIG) report higher levels of EC than the students assigned to the waiting control group (WCG).*

### 3. Methodology

The study employed a survey methodology implementing the recently validated EC questionnaire [9]. A randomized quasi-experimental pre-group–post-group design explored the target group students' EC attributes before and after the educational intervention, in comparison to control group students. The survey data was collected during November 2020–January 2021 through a SurveyMonkey platform (CAWI surveying technique) and is made open access via http://www.lidata.eu/data/quant/LiDA_KITI_0347 (accessed on 23 July 2021). Ethical approval was granted by the Institute of Social Sciences, Arts and Humanities at Kaunas University of Technology (protocol no. V19-1253-7-1). It has to be noted that the quasi-experiment was conducted under COVID-19 pandemic conditions that included internal and cross-border movement restrictions and fully online learning.

#### 3.1. Participants and Sampling Procedure

The study was conducted with first year university students from different study areas (humanities, social sciences, arts, technology, science, engineering, or mathematics) at Kaunas University of Technology, Lithuania. The participants represent two populations. The first population consists of the students who chose the 'Sustainable Development' course as their general electives option in the Fall semester, 2020 ($N_1 = 205$). This is the intervention population, in which we expect changes in the students' EC as a result of studying the course. The intervention population participants were randomly assigned either to the pre-intervention group (PIG) or the waiting intervention group (WIG). The second population of students ($N_2 = 268$) are those that chose the 'Media Philosophy' course as their general electives option in the Fall semester, 2020. This serves as a control group. The control group participants were randomly assigned either to the pre-control group (PCG) or the waiting control group (WCG). The majority of participants were engineering sciences majors (47.1%), technological sciences majors (20.7%), physics majors (10.1%), social sciences majors (7.1%), and arts majors (5.0%). The remaining 10% studied in diverse disciplines (mathematics, computing, humanities). The average age of the participants was 19.5 years (SD = 2.9 years) with a median and modulus of 19 years. The two youngest participants were 17 and the oldest and second oldest participants were 50 and 26 years, respectively. Gender distribution was 46.4% males, 50.7% females, and 2.9% who preferred not to state their gender (the option "other" was not selected). Background data of the participants are presented in Table 1.

**Table 1.** Gender, age, and study programs of the participants.

| Categories | Frequency | Percentage (%) |
|:---:|:---:|:---:|
| **Gender** (Valid N = 140) | | |
| Female | 71 | 50.7 |
| Male | 65 | 46.4 |
| I'd rather not say | 4 | 2.9 |
| **Age** (Valid N = 137) | | |
| 17–18 years | 20 | 14.6 |
| 19–20 years | 104 | 75.9 |
| 21–22 years | 7 | 5.1 |
| 23–25 years | 4 | 2.9 |
| 26–50 years | 2 | 1.5 |
| **Program** (Valid N = 140) | | |
| Engineering sciences | 66 | 47.1 |
| Technological sciences | 29 | 20.7 |
| Physical sciences | 14 | 10.0 |
| Social sciences | 10 | 7.1 |
| Arts | 7 | 5.0 |
| Mathematical sciences | 5 | 3.6 |
| Others | 9 | 6 |

Comparability of the intervention group and the control group is the major prerequisite for valid conclusions in experimental designs (Engel and Schutt, 2014). We thus checked for the bias and found no significant differences between the intervention and the control group participants in terms of their residence prior to university studies (urban/rural), the gender structure, the study fields, frequency of nature experience, positivity of nature experience, connection to nature, and interest in nature during childhood and youth. Male and female participants were distributed equally in both courses, excluding missing gender information (Chi-square test, df = 1; $p = 0.864$).

The pre-test questionnaire was administered in November to 103 students in the SD course and 134 students in the media philosophy course. The same post-test questionnaire was administered in January 2021 to 102 students in the SD course and 134 students in the media philosophy course. Participation in the questionnaire was anonymous. We should note here that the students in the pre and post conditions are not the same students. Students were, rather, randomly appointed to either a pretest or a posttest survey. At both measurement occasions, the response rates for the pre-test and post-test of students in both courses was circa 50%, therefore, the total final number of respondents was 206.

*3.2. Instrumentation*

*Background data*—Students' gender, age, major field of studies, socioeconomic class (lower, working class, middle class, upper class), current employment (yes/no), native tongue and that most used currently.

*Environmental Citizenship*—The students' environmental citizenship characteristics were investigated with the 'Environmental citizenship questionnaire (ECQ), developed and validated for secondary school students by Hadjichambis and Paraskeva-Hadjichambi [9]. The questionnaire includes the following EC areas (variables), organized in Table 2, and employs Likert-type scales with four possible scores. Reported Cronbach alpha values range from 0.703 to 0.903 [9]. All scales are 4-point Likert-type scales with the answer options ranked from 1—low to 4—high, except the scale 'past actions' (which has answer options ranked from high to low). For this reason, in the calculations of scale means, etc., the items of the past action scale were inverted.

**Table 2.** EC variables, number of items, and exemplar items of the ECQ. All variables were explored with Likert-type scales with four possible responses.

| EC-Variable | No. of Items | Exemplar Item |
|---|---|---|
| Past and present EC actions | 6 | Have you ever been involved in activities of an environmental organization outside school or university? (INV *) |
| EC knowledge | 11 | Before entering university, to what extent have you learned what are the environmental rights and duties of a citizens? |
| EC conceptions | 12 | In your opinion, how important is participating in activities to benefit the environment for being a good citizen? |
| EC skills | 6 | How well do you think you would do, now as a student, in arguing your point of view about a controversial environmental issue? |
| EC attitudes | 8 | To what extent do you agree that companies in rich countries should give employees in poor nations the same conditions as in rich countries |
| EC values | 15 | How important for you personally is it that every person has equal opportunities? |
| Future actions inside university | 4 | If you were given the chance, how likely is it that you would take part in environmental discussion in a student assembly, if offered at your university? |
| Future actions outside university | 11 | As a citizen would you take stage a protest by blocking traffic? |
| Agents of change | 3 | How likely is it that you would actively participate in decision making and also engage in action-taking? |

* INV = inverted items.

*General environmental attitudes*—Students' general attitudes regarding the environment were assessed with six statements (for example, 'For the sake of the environment, we should all be prepared to reduce our current standard of living'; 'The importance of environmental problems is greatly exaggerated by many environmentalists') to which the respondents rated their extent of agreement on a Likert scale with 4 possible responses. The brief General environmental attitudes scale formed by these items was developed and applied in previous research by Hansmann and Binder [50].

*Experience with nature*—This section explored: (1) the type of environment the student grew up in (clearly urban, rather urban, in-between, rather rural, clearly rural) as a child (age 6–14) and as a youth (age 15–18); (2) Extent of experience in nature (very rarely, rarely, rather rarely, rather frequently, very frequently) in these two age periods; (3) How positive their experience in nature was (very positive, positive, rather positive, rather negative, negative, very negative); and (4) Sense of connection to nature (very distant, distant, rather distant, rather close, close, very close) in these two age periods; (5) Extent of interest in nature (not at all, to small extent, to moderate extent, to large extent, to very large extent) in both age periods.

*Subjectively reported university-based and external influences.* These two items aim to isolate the influences of the complex educational intervention from other possible influences. The first question measured the subjectively reported university-based influences: 'Thinking about the time you have spent in the university, in which university courses did you learn about: environmental values, issues and/or behaviors; citizenship related topics' (only in my general electives course, mainly in the general electives course but also in other course/es, equally in the general electives and other course/es, mainly in other excluding the general electives course/es, in none of my courses). The second question measured subjectively reported external influences: 'In the last few months, to what extent have you learned about these topics in extra-curricular activities (not based on formal university courses): environmental values, issues and/or behaviors; citizenship related topics' (not at all, to a small extent, to a moderate extent, to a large extent).

*Attitudes towards instruction and learning methods.* In order to better understand if the intended instruction and learning methods were effective, we introduced the question 'How helpful were these course-related elements for your learning?' (theory lectures, activities based on design thinking approach, team of lecturers from different disciplines,

group work with my peers, topics and/or activities that required my analytical thinking, topics and/or activities that made me to think of relations between different real-world issues, topics and/or activities that made me to reflect upon my value system, topics and/or activities that made me to reflect upon my ethics and behaviors, topics and/or activities that made me think about my future, game-based activities, other). Possible responses ranged from 1—not important at all, to 4—very important, and an additional response 5—I did not notice this in my course.

### 3.3. Data Analysis

All statistics were conducted using the IBM Statistical Package for Social Sciences (IBM SPSS 26). To map the psychometric qualities of the EC instrument in this novel context, several estimates were used. The scale's reliability was estimated by calculating Cronbach alpha values for the construct as a whole as well as for each individual subscale, tapping into the different attributes of EC. Convergent validity was tested through calculating Pearson's correlations between EC and environmental attitudes. Similarly, the external validity of the EC instrument was tested by estimating gender differences (*t*-test) and Pearson's correlation with nature experiences. Descriptive statistics (mean, standard deviation) were calculated and differences among student groups were investigated with ANOVA and post-hoc analyses. For the computation of the EC scale values, missing values of some persons in single items were imputed with mean values of each item to decrease an accumulation of missing values resulting in data exclusion. Therefore, all analyses involving the overall EC scale include imposed values for some persons in some items. The share of imputed missing responses of the valid participants in the 73 items of the EC questionnaire ranged from a minimum of 0% to a maximum of 32%, and the average share was 21%. The overall mean was used as an imputation method because it does not change the overall sample mean for the EC items. Furthermore, using the overall mean as an estimate is conservative in the sense that between group differences are not artificially (or randomly) enlarged by it. Subgroup means are directed towards the overall mean by this estimation technique so that the resulting bias tends to be conservative and tends to prevent random significances in between group comparisons.

## 4. Results

### 4.1. Psychometric Quality of the ECQ and Descriptives of Students' Environmental Citizenship

This subsection presents with reliability, convergent validity, and external validity measures of the ECQ as used in our study. Table 3 shows the results of the descriptive statistical analyses for the entire dataset of 206 students, as well as the number of items for each scale and its internal consistency. Cronbach's alpha values ranged from 0.836 to 0.929 across the different scales, indicating excellent reliability of the scales, in line with scale reliability reported by Hadjichambis & Paraskeva-Hadjichambi [9]. For each scale, we report the mean values and the standard deviation on the number of students that provided responses. Evident from the table, the number of respondents decreases with each next scale. This is linked to the order of the scales in the survey, and, therefore, reflects the increasing drop out as students progressed through the survey.

The correlations of EC scale with general environmental attitudes (EA) were analyzed to investigate the convergent validity of the EC. The average value of the participants on the general environmental attitude scale was M = 3.0 (SD = 0.48) on the four-point scale. A moderate but significant correlation (r = 0.35, *p*< 0.001) between environmental attitudes and EC was found, which indicates the relationship between both concepts: Through its focus on pro-ecological socio-political behaviors, cognitive competencies, and future orientations, EC represents a much broader concept (construct) than environmental attitudes and values, but EC entails environmental attitudes as an inherent component facilitating EC behaviors [50–52]. A medium- to high-level correlation between EC and environmental attitudes, as observed in this study, could hence be expected.

Table 3. Descriptives and Cronbach's alpha for the entire dataset of student's EC (score range is 1–4).

| Scale | | | All Data | | |
|---|---|---|---|---|---|
| Construct | Items | $\alpha$ | $n$ | $M$ | $SD$ |
| Environmental citizenship | 76 | 0.929 | 206 | 2.45 | 0.57 |
| Past actions (INV [1]) | 6 | 0.832 | 206 | 1.45 | 0.67 |
| Knowledge for EC [1] | 11 | 0.916 | 183 | 2.52 | 0.60 |
| Conceptions for EC | 12 | 0.836 | 167 | 3.07 | 0.42 |
| Skills for EC | 6 | 0.852 | 160 | 2.45 | 0.62 |
| Attitudes for EC | 8 | 0.856 | 151 | 3.39 | 0.45 |
| Values for EC | 15 | 0.834 | 145 | 3.1 | 0.42 |
| Future actions in school | 4 | 0.864 | 144 | 2.17 | 0.66 |
| Future actions outside school | 11 | 0.863 | 141 | 2.18 | 0.52 |
| Agents of change | 3 | 0.866 | 141 | 2.82 | 0.66 |

[1] EC = Environmental Citizenship, INV = inverted items.

## 4.2. Environmental Citizenship Attributes of the First Year University Students

Table 4 presents the mean values for the EC variables as well as the overall mean EC value for each of the research groups. The overall mean for EC indicates a slightly below moderate level of environmental citizenship. A deeper look into the different EC competencies indicates a complex picture concerning the different dimensions of EC. In the behavioral domain, the students report insignificant previous involvement in environment-related actions (over a year ago to no involvement). Furthermore, they report limited intention to be involved in the future in environment-supportive actions associated with EC either within the campus or in their personal lives, but slightly higher intentions to function as social change agents of sustainability. In the cognitive domain, they report less than moderate (exposure to) knowledge of topics relevant for EC and feel that they would do less than fairly well in various skills associated with EC. On the other hand, in the affective domain, despite their limited reported involvement in actions associated with EC, they perceive EC-related behaviors to be important, demonstrate pro-environmental attitudes/positive attitudes concerning social-environmental aspects related to EC, and positively identify with social-environmental values associated with EC.

Table 4. Descriptive statistics for EC attributes of students from the four groups (Score range is 1–4).

| Scale | PIG [1] | | | PCG | | | WIG | | | WCG | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $n$ | $M$ | $SD$ | $n$ | $M$ | $SD$ | $n$ | $M$ | $SD$ | $n$ | $M$ | $SD$ |
| Environmental citizenship | 54 | 2.41 | 0.52 | 60 | 2.38 | 0.59 | 47 | 2.68 | 0.52 | 45 | 2.43 | 0.39 |
| Past actions (INV) | 54 | 1.43 | 0.69 | 60 | 1.43 | 0.57 | 47 | 1.39 | 0.69 | 45 | 1.44 | 0.74 |
| Knowledge for EC | 49 | 2.41 | 0.57 | 55 | 2.55 | 0.58 | 37 | 2.67 | 0.68 | 42 | 2.46 | 0.59 |
| Conceptions for EC | 46 | 3.05 | 0.38 | 50 | 3.03 | 0.46 | 33 | 3.04 | 0.49 | 38 | 3.17 | 0.32 |
| Skills for EC | 44 | 2.41 | 0.58 | 48 | 2.3 | 0.64 | 32 | 2.94 | 0.67 | 36 | 2.58 | 0.56 |
| Attitudes for EC | 41 | 3.42 | 0.42 | 47 | 3.34 | 0.52 | 29 | 3.29 | 0.46 | 34 | 3.46 | 0.35 |
| Values for EC | 40 | 3.04 | 0.36 | 46 | 3.04 | 0.41 | 27 | 3.16 | 0.5 | 32 | 3.18 | 0.4 |
| Future actions in school | 40 | 2.14 | 0.62 | 46 | 2.03 | 0.71 | 27 | 2.29 | 0.58 | 31 | 2.29 | 0.71 |
| Future actions outside school | 40 | 2.14 | 0.49 | 45 | 2.14 | 0.6 | 25 | 2.23 | 0.57 | 31 | 2.22 | 0.41 |
| Agents of change | 40 | 2.82 | 0.57 | 45 | 2.71 | 0.78 | 25 | 2.84 | 0.65 | 31 | 2.93 | 0.57 |

[1] PIG = pre-intervention group, PCG = pre-control group; WIG = waiting intervention group; WCG = waiting control group, EC = Environmental Citizenship, INV = inverted items.

## 4.3. Correlations between Students EC and Their Background Variables

Analyses of gender differences and differences according to nature experiences in childhood and youth were employed to investigate the external validity of the ECQ. The average value of EC among females was M = 2.73 (SD = 0.32) and of males M = 2.54 (SD = 0.41). This difference was statistically significant ($p = 0.002$). Females also showed significantly ($p = 0.007$) stronger positive EA (M = 3.10, SD = 0.42) compared to males (M = 2.85, SD = 0.52). The higher values of EC in female students compared to male students is consistent with previous studies on students as well as on general populations, which found more pro-environmental attitudes and environmentally responsible

behaviors of females compared to males [10,37,38,53,54]. The current study thus confirms stronger pro-environmental orientations and social and behavioral competencies of females regarding the ECQ scale.

Growing up as a child in a rural versus urban surroundings was not related to environmental citizenship (r = 0.06, $p > 0.05$) nor was it related to environmental attitudes (r = 0.03, $p > 0.05$; see Table 5). The frequency of nature experiences during childhood was likewise not significantly related to EC (r = 0.14, $p > 0.05$) and EA (r = 0.10, $p > 0.05$). The positivity of nature experiences during childhood was significantly positively related to both EC and EA (EC: r = 0.17, $p < 0.05$; EA: r = 0.38, $p < 0.001$). The connection of nature in childhood was positively correlated with EC (r = 0.32, $p < 0.001$) and with EA (r = 0.29, $p < 0.001$) to a smaller degree. The interest in nature as a child was slightly more strongly correlated with EC (r = 0.43, $p < 0.001$) than with EA (r = 0.23, $p < 0.01$).

**Table 5.** Correlations between EC, EA, and variables related to nature experiences in childhood and youth.

| | Urban vs. Rural | Frequency of Nature Experience | Positivity of Nature Experience [1] | Connection to Nature | Interest in Nature |
|---|---|---|---|---|---|
| Childhood | | | | | |
| EC | 0.06 | 0.14 | 0.17 * | 0.32 *** | 0.38 *** |
| EA | 0.03 | 0.10 | 0.38 *** | 0.29 *** | 0.23 ** |
| Youth | | | | | |
| EC | −0.07 | 0.17 * | 0.19 * | 0.22 ** | 0.39 *** |
| EA | −0.01 | 0.17 * | 0.29 *** | 0.18 * | 0.26 ** |

[1] scale recoded so that high values reflect positive experiences. For all bivariate correlations, $n = 140$. * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed). *** Correlation is significant at the 0.001 level (2-tailed).

Contrary to the correlations reported for childhood aspects, the frequency of nature experiences in youth was significantly positively related to both EC and EA (for both EC and EA: r = 0.17, $p < 0.05$). Apart from this, the same significant correlations regarding nature experiences during childhood were also found for youth. This means that while EC and EA are not related to the specific environment (urban/rural) in which the students grew up in, EC and EA are significantly positively related to the students' positive nature experiences, interest in nature, and sense of connectedness to nature during their childhood and youth (Table 5). nature experiences during youth and positive nature experiences during youth and childhood thus proved to be positively correlated with EC and EA. This is in line with various previous studies showing a positive correlation between early nature experiences and environmental attitudes and behaviors in adulthood [55–57].

*4.4. Impact of the Intervention on Students' EC*

ANOVA analyses showed that when comparing the four student groups for each of the environmental citizenship scales, no main effects were present (all $p > 0.05$), suggesting that the intervention had no effect on the different scales. However, when the four groups were compared based on the overall construct of environmental citizenship (including all items of all scales), the results indicate meaningful and significant differences, with the main effect estimates of F = 3.508 (df = 3) and $p = 0.016$. Two-by-two post-hoc analyses (Fisher's Least Significant Difference) revealed which differences occurred among which groups (see Figure 1). As could be expected (H1), no differences were found between the pre-intervention group and the pre-control group. Likewise, no differences were found between the pre-control group and the post (waiting) control group (H2) (all $p > 0.05$). As hypothesized (H3), the post (waiting) intervention group displayed significantly higher EC than the pre-intervention group (M.diff = 0.273, $p = 0.007$), and significantly higher EC as compared to the post (waiting) control group (H4) (M.diff = 0.251, $p = 0.025$). Using Cohen's d to qualify the effect size shows a medium effect (d = 0.52) for the pre–post comparison of the intervention group, and medium effect (d = 0.52) for the post-intervention control comparison.
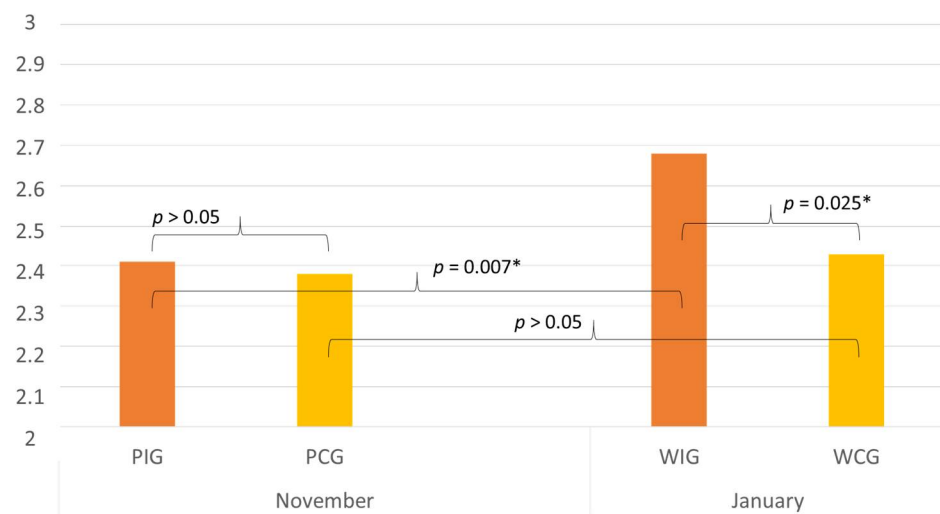
**Figure 1.** Mean values of EC for the four groups and significance of mean differences.

Evaluating complex interventions requires the careful consideration of the various contexts and factors that also might influence the dependent variables (i.e., EC attributes). To account for the large variation of personal contexts of the intervention course students' backgrounds, we solicited subjectively reported information via two questions "Thinking about the time you have spent in the university, in which university courses did you learn about: environmental values, issues and/or behaviors and citizenship related topics", and "In the last few months, to what extent have you learned about these topics in extra-curricular activities (not based on formal university courses): environmental values, issues and/or behaviors; citizenship related topics".

An absolute majority of the intervention course students said they learned about environmental values, issues and/or behaviors (95.6%) and learned about citizenship-related topics (84.6%) only or mainly in the course. The students from the intervention group also reported more isolated influences of the course on their learning about environmental values, issues, and/or behaviors (M = 1.51, SD = 0.66) as compared to the control group (M = 2.45, SD = 1.27; t(137) = −6.3, $p$ = 0.000) and learning about citizenship related topics (intervention group M = 1.64, SD = 0.97, and control group M = 2.36, SD = 1.26; t(170) = −4.33, $p$ = 0.000).

One third of the intervention group said they learned about environmental values, issues, and/or behaviors (38.5%) and learned about citizenship related topics (29.7%) to a large or moderate extent in the extra-curricular activities (external, non-university-based influences). Students from the intervention group (M = 2.3, SD = 0.98) compared to the control group participants (M = 1.99, SD = 0.85) reported lower influences of external extra-curricular activities on their learning about environmental values, issues, and/or behaviors, t(181) = 2.27, $p$ = 0.024. Significant differences were found between the intervention and control group students' reported influences of external extra-curricular activities on their learning about citizenship-related topics.

The influence of the intended educational intervention is well isolated in terms of the university-based educational influences (other courses did not have influence, and there were no other university-related activities due to COVID-19 lockdown), but only partially isolated from external influences. The context of the global COVID-19 pandemic, and the overlapping discourses of the climate crisis and environmental degradation, might have introduced biases. These issues have been widely discussed in Lithuania during the period of the study and were related to calls for citizen action and citizen awareness, especially related to the public health crisis.

The second set of factors important for the experimental conditions is related to the actual effects of the instructional design. The intervention group students found these elements to have been important for their learning (where 3 = "Quite important" and

4 = "Very important"): activities that made students think about the relations between different real-world issues (M = 3.4, SD = 0.73), activities that asked for future thinking (M = 3.4, SD = 0.75) or for reflection on ethics and behaviors (M = 3.3, SD = 0.76), activities that require analytical thinking (M = 3.3, SD = 0.8), activities that asked to reflect on personal values (M = 3.3, SD = 0.81), multidisciplinary team of lecturers (M = 3.2, SD = 0.85), game-based activities (M = 3.2, SD = 0.87), group-work with peers (M = 3.2, SD = 0.9), design thinking activities (M = 3.0, SD = 0.83), and theory lectures (M = 3.0, SD = 0.87). One of the learning and instruction elements (LI elements of the CLIA model) was particularly important for the intervention group students. The students from the intervention group (M = 3.2, SD = 0.9) compared to the control group participants (M = 2.86, SD = 0.92) reported higher importance of group work with peers, t(112) = 1.99, *p* = 0.049. There were no other significant differences in terms of intervention and control group students' evaluations of the importance of various learning and instruction elements.

## 5. Discussion

Environmental citizenship is a crucial construct in education [52]. As we face the wicked problems that characterize the Anthropocene, it is clear that an informed and active environmental citizenship is needed. To tackle or prevent environmental issues, citizens need to act and participate as agents of change in the private and public spheres, both individually and collectively [2,58,59]. Many educational initiatives target environmental citizenship as a learning goal, and much effort is invested in formal and informal educational settings to provide students with learning experiences that foster environmental citizenship. Institutions of higher education have a crucial role to play in this aspect.

In this paper, we set out to explore the impact of a general elective course offered to incoming undergraduate students at a large technical university in Lithuania, which focuses on sustainable development, in terms of increasing the environmental citizenship among the participating students. We designed a quasi-experimental, randomized, pre-group–post-group study in which the environmental citizenship attributes of students in the experimental course (focused on sustainable development) were compared to those of students in a control course unrelated to environmental issues (focused on media philosophy). To measure the environmental citizenship attributes of students, we applied the recent instrument developed by Hadjichambis & Paraskeva-Hadjichambi [9]. Our results show a significant impact of the experimental course on the students' EC. Given that it was the first time that this new instrument was used in the context of higher education, we took several steps to assure its psychometric qualities. We will first discuss the results concerning the psychometrics of the instrument and then zoom in on and discuss the impact of the intervention. Finally, we will address limitations of the study and offer directions for present and future research in the field of education for environmental citizenship.

### 5.1. Validity and Reliability of the ECQ

Given the complexity of environmental citizenship, constructing knowledge, cultivating values and attitudes, and promoting active engagement in pro-environmental actions, it is difficult to assess whether and to what extent such initiatives achieve the goals they set out to reach. In 2020, Hadjichambis and Paraskeva-Hadjichambi developed a survey instrument for measuring the environmental citizenship of Cypriot students in secondary education: the environmental citizenship questionnaire or ECQ [9]. It is this instrument that we used in the current study. We introduced three innovations in the application of the ECQ: (1) we used it in another cultural context (Lithuania) than the one it was originally developed in (Cyprus); (2) we surveyed students in higher education rather than secondary education; and (3) we applied it in an intervention design rather than in a cross-sectional design. As such, our study does not only report on the impact of the educational intervention we evaluated, but it also contributes evidence for the qualities and application of the ECQ in such research.

To test the basic assumptions regarding the reliability and validity of the instrument, we assessed its internal consistency through the estimation of the Cronbach's alpha values for the entire instrument as well as for each of its nine subscales. Our results (see Table 3) show that each of the scales has excellent reliability, with all alpha values ranging between 0.830 and 0.930. The alpha value for the entire instrument is 0.929, indicating that there is also excellent internal consistency at the overarching conceptual level. It should be noted, though, that the estimation of Cronbach's alpha is influenced by the number of items in a scale, so it can be expected that a high value for the entire scale (with 76 items in total) would be reported. However, given that all subscales (ranging between three and 15 items) show high alpha values as well, it is fair to conclude that the ECQ can be used to reliably measure the environmental citizenship of higher education students in Lithuania. These results, together with those of Hadjichambis and Paraskeva-Hadjichambi [9] suggest that the instrument can be used in diverse educational contexts and with diverse ages to tap the environmental citizenship of learners in the context of educational interventions. While we found the ECQ to be reliable, in the current study we did not take an in-depth look at the validity of the instrument. Some of our results do, however, support initial claims of validity of the ECQ in this novel context. The differences we observed between male and female students (elaborated further on) point towards discriminant validity: the instrument has the potential to discern the EC among specific groups of students. The correlations found between environmental citizenship and environmental attitudes (also elaborated further on) point towards convergent validity: the theoretically related concepts correlate significantly and meaningfully. These results support the potential validity of the ECQ. Future efforts should focus on establishing the construct validity of the instrument through exploratory and confirmatory factor analyses.

### 5.2. Correlates of EC in Lithuanian Undergraduate Students

This study has shown that female undergraduate students display higher levels of EC compared to the male students as well as more positive environmental attitudes. This corresponds with findings of previous studies which have (relatively) consistently shown more pro-environmentalism (as reflected in positive environmental attitudes, values, and/or behaviors) among female students and adults compared to males [34–36,38,50]. The current study nevertheless adds valuable insights to previous research as it distinguished between environmental citizenship and general environmental attitudes and investigated the correlation among these. A moderate but significant correlation between the students' responses to the ECQ questionnaire and a measure of environmental attitudes developed by Hansmann and Binder [50] was observed. This points towards the potential role that attitudes play as a motivational component of EC. However, EC is a broad and encompassing concept, as reflected in the subscales of the ECQ instrument. Enacting EC does not only require pro-environmental attitudes, motivations, and value orientations, but also involves a broad range of further attributes, such as competencies and skills—including socio-political and communication skills—as well as an in depth understanding of social and environmental systems as entailed, for example, in the concept of environmental literacy [52,60,61]. Therefore, much higher correlations between environmental attitudes and EC may not be expected.

The close linkage between EC and environmental attitudes is also reflected in the similarity of their connection to third variables such as gender, and to nature experiences during childhood and youth. The current findings support and add to previous studies which have shown that a connection to nature and positive nature experiences during childhood and youth are positively related with pro-environmental values and behaviors during later life stages [33,55–57,62,63]. Both an interest in nature and a connection to nature during childhood and youth were found in this study to be positively correlated with environmental attitudes and even more strongly with the overall EC of the students. Furthermore, in line with previous studies, the positivity of nature experiences during childhood and youth was positively related to both the EC and environmental attitudes

of students [56,57,64]. On the other hand, while the frequency of contact with nature during youth was found to be significantly positively correlated with both the EC and environmental attitudes of the students, no corresponding significant relationships were found for the frequency of contact with nature during childhood. The latter results seem inconsistent with previous studies, but in the context of the other observed correlations of this study, they mainly seem to re-emphasize the importance of the positive character of nature experiences during childhood and youth for the development of young adults' EC and positive attitudes towards nature [33,56,65,66]. Furthermore, the lack of correlation between the residential settings—urban or rural—in which the participants grew up and their current EC and environmental attitudes also support that it is specifically the positive nature experiences and the sense of connection to nature that these nurture, which are meaningful for cultivating the individual's positive environmental attitudes and environmental citizenship. Children and youth growing up in urban areas may have significant nature experiences as a part of family leisure activities or other experiences such as summer camps.

In summary, the findings on self-reported nature experiences and relations to nature during childhood and youth indicate that interest in nature, connectedness to nature, and frequent (in particular, positive) experiences in nature during childhood and youth are highly important for the development of young adults' EC. According to Kellert et al. [67], "Play in nature, particularly during the critical period of middle childhood, appears to be an especially important time for developing the capacities for creativity, problem-solving, and emotional and intellectual development" (p. 83). The interest in nature comprises the cognitive motivation of children and youth to acquire the knowledge, environmental literacy, and problem-solving skills which thus form the basis from which young adults can later on further develop their EC [52,60,61,68]. For children and youth, as well as for adults, nature experiences represent a main basis for the development of environmental literacy and a close connection to nature, which can be considered integral aspects of EC [33,64]. Studies on the relationship between individuals' (of different demographic backgrounds) connectedness to nature and self-reported involvement in environmentally responsible behavior support a strong positive relationship [39], leading the authors to conclude that facilitating individuals to develop a sense of connectedness to nature should be one of the goals of EE programs and interventions as well as one of the assessments of such interventions. A recommendation stemming from this for the SD course implemented at Kaunas University of Technology is to incorporate instructional components that cultivate the students' sense of connectedness to nature.

### 5.3. Impact of the Educational Intervention

The findings of this study indicate a complex picture regarding the influence of the uniquely designed general elective course on the first-year students' environmental citizenship. On the one hand, the findings confirm all four of the hypotheses put forth: no differences were found between the pretest intervention and control groups (H1) nor between the posttest and pretest control group (H2); the environment citizenship of the posttest intervention group was significantly greater than that of both the pretest intervention group (H3) and the posttest control group (H4). Together, these results indicate a significant and positive impact of the sustainable development course on the students' environmental citizenship. We should recognize that the effect size was medium in term of its Cohen's d estimate, and that significant effects were found only for the construct of environmental citizenship as a whole, and not for the separate attributes that fall under the construct (EC-related knowledge, attitudes, future actions, or intentions to act as an agent of change). This does not enable us to discern the differential effects of the course on the specific components that together comprise the student' EC.

In order to differentiate between general influences on students' EC attributes that may occur during the academic experience and the influences related to the instructional methods employed in the teaching of the SD intervention, we compared the extent of

importance with which students acknowledge the various instruction methods between students participating in the intervention course and the control group. Students who participated in the SD course substantiated that it was this course that exposed them to environmental issues as well as to EC-related aspects. This indicates that the influence of the course is isolated from other university-related educational influences. Despite this, looking deeper into the various instructional methods that were implemented in the delivery of the course and that are acknowledged as meaningful for environmental education (see introduction), the (intervention) students perceived these as only moderately important (scores 3.0 > 3.5) and aside from teamwork with peers, no differences were found between the two groups of students. These findings may be related to the fact that the course was conducted during the COVID-19 pandemic, which placed severe restrictions, thus it was unable to realize the teaching–learning methods to their full potential. The significantly greater importance of teamwork with peers acknowledged by the intervention group seems to underscore the students' perception of the limitations imposed on their academic experience during social isolation; of the different pedagogies implemented, peer teamwork (conducted online in conditions of social isolation) was what made the most impression on them and was most appreciated. Although the only moderate influence acknowledged by the students may be tied to the learning conditions at the time of the study, other studies with HE students at different stages during their studies have also found that students acknowledge only modest influence of their studies to components of their environmental literacy [28,69]. Another methodological limitation is that the students' response to the questionnaire was voluntary, leading to the possibility of self-selection bias. However, the students who participated in the intervention course did not differ from students who participated in the control course in relation to various variables, which rather suggests that self-selection did not affect the two conditions asymmetrically.

Since we observed a relatively high average percentage of missingness when calculating the overall score for the students' environmental citizenship, we should look critically at our approach to calculating the overall mean EC values. To decrease respondent exclusion, we imputed missing values with average values when calculating the overall scale mean. Horton and Kleinman [70] describe that such an approach can cause bias since it artificially decreases variability in the sample. As described in the results section we report a mean of 21% imputed values. It should also be noted, though, that the bias described by Horton and Kleinman [70] would in the case of the current study not result in an increased chance of false positive results, but rather in an increased probability of a false negative result. So, the validity of the main finding of the positive effect of the sustainable development course on environmental citizenship is not threatened by the selected imputation method.

This study also enabled us to provide an overall picture of the environmental citizenship characterizing the participating students. Overall, the EC-attributes of these first-year students reflect a below moderate level of EC. While they demonstrate a pro-environmental orientation in the affective domain, reflected in their identification with social-environmental values associated with EC and environmentally supportive attitudes, they demonstrated limited intentions for involvement in environmentally supportive behaviors/actions, a limited sense of self-efficacy in relevant skills, and limited exposure to relevant knowledge. This picture is not unique to this group. Other studies exploring the environmental literacy attributes with HE students demonstrate similar findings: there is an overall below moderate level of environmental literacy, and looking at the various components, the highest levels are demonstrated in the affective domain and decrease in the cognitive and behavioral domains [28,69]. In view of the crucial role of HE in developing cadres of graduates committed to and capable of promoting sustainability, in their personal and professional lives [12,14,15] the findings indicate an ongoing challenge confronting HE.

## 6. Conclusions

In the context of education for sustainability, Rickenson et al. [71] emphasize the importance of connecting the influences of educational interventions and what it is about the programs that are influential in creating these impacts. This study provides a response to this direction of study, which is still largely underexplored in the context of higher education [14], by investigating the influence of a unique course developed to target the characteristics of environmental citizenship via a holistic and multidisciplinary approach and implementing various teaching methods associated with developing competences and agency in the context of sustainability [26]. A noteworthy value of this study is its implementation of the new instrument, the ECQ, developed as a tool for measuring components of environmental citizenship. While the findings indicate the psychometric quality of the instrument when used with HE students, an important direction for further study is to establish the construct validity of the instrument. A limitation of the study lies in its execution during the severe limitations necessitated during the COVID-19 pandemic. Long distance online learning did not enable us to fully and optimally implement the various instructional methodologies on which the intervention course is based. In view of the aim in connecting student outcomes and educational processes, it is important to repeat this study under an academic situation that is not grounded solely on long distance learning and with a larger cohort of students. A larger student cohort may also enable the identification of the influence of the course on the specific cognitive, affective, and behavioral variables that comprise environmental citizenship. From a methodological perspective, the recently developed ECQ provides an important contribution. In view of the paucity of instruments for measuring individual's environmental citizenship, parallel to increasing interest in educating for environmental citizenship, a direction of future work is to broaden the understanding of the relationships between the components that comprise EC and constructs and attributes (beyond those investigated in this study) that are reported in the literature in the context of environmentally responsible citizenship.

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