First-year higher education student environmental literacy – the Algarve University case

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Abstract

The study aims to contribute to characterizing the environmental literacy profile of students entering higher education in Portugal and to explore associations between sociodemographic variables and environmental knowledge, attitudes, and behavior. A questionnaire survey was conducted with a stratified sample of 451 first-year undergraduate students from the University of the Algarve (southern Portugal). Results suggest that students demonstrated moderate environmental knowledge, positive attitudes toward the environment, and moderately positive pro-environmental behaviors. Evidence of relationships between students' environmental literacy profiles and sociodemographic aspects such as gender and scientific areas of study provides insights for future discussions and promotion of environmental education and culture in higher education institutions in Portugal. This will enable them to play an effective role in enhancing students' environmental literacy and citizenship.

Keywords: Environmental literacy; Environmental attitudes; Environmental behaviour; Environmental knowledge; higher education students; Portuguese sample.

1. Introduction

For nearly 50 years, humanity has been exploiting resources and emitting pollution far beyond the planet's capacity. Efforts in environmental education have been implemented worldwide over the past decades, yet the depletion of global resources continues to escalate year after year. A populace that is environmentally literate is considered essential for improving the quality of the environment (Disinger & Roth, 1992). To assess the achievements of environmental education, scholars have focused on evaluating outcomes such as environmental knowledge,

awareness, attitudes, intentions, enjoyment, and behavior (Stern et al., 2014). The term "environmental literacy" was introduced within the context of environmental education (Roth, 1992), with the belief that environmental education globally contributes to enhancing the environmental literacy of its target audience (Stern et al., 2014). Environmental literacy primarily encompasses knowledge, attitudes, dispositions, and competencies that individuals need to effectively analyze and address environmental issues (Hollweg et al., 2011). Environmental knowledge, attitude, and behavior are considered major components in characterizing environmental literacy (Hallfreðsdóttir, 2011; Krnel & Naglič, 2009; Negev et al., 2008; Spínola, 2014), assumptions that underpin the context of the present study.

In Portugal, limited evidence regarding the effectiveness of environmental education has emerged, particularly within the Eco-Schools Program (Spínola, 2015, 2016, 2020). The scant studies available for higher education (e.g., Amador et al., 2015; Caeiro et al., 2020; Farinha et al., 2018; Fonseca et al., 2018) suggest that the weaknesses identified at previous education levels may be further exacerbated here. A deeper understanding of the effectiveness of environmental education in Portugal is necessary to facilitate improved practices and strategies within the higher education context.

The study sought to contribute to understanding the levels of environmental knowledge, attitudes, and behaviors among students beginning higher education in Portugal, and to explore their relationships with socio-demographic aspects such as gender or family literacy.

2. Method

An anonymous survey questionnaire was conducted to characterize students' environmental literacy profiles, including knowledge, attitudes, and environmentally responsible behaviors, and to gather socioeconomic and demographic data. The questionnaire received prior approval from the Ethics Committee Board and the Data Protection Officer, and underwent pre-testing to ensure reliability and validity. It begins with a brief introduction outlining the study's aim, assures participants of confidentiality, and provides information necessary for participants to give their informed consent. The questionnaire is divided into two sections: 1) Respondent's socioeconomic status (including family income, parents' literacy), demographic variables (such as gender, age), secondary school grade, and engagement in environmental education projects and activities; 2) Respondent's environmental knowledge, pro-environmental attitudes, and behaviors toward the environment.

To assess environmental knowledge, the questionnaire addresses topics such as environmental resources and concepts, challenges and solutions, as well as broader aspects including biodiversity, sustainability, and circular economy, alongside key areas like waste, water, energy, and climate change. It comprises 39 questions presented in a multiple-choice format, where participants are required to select the correct responses. These queries were adapted from prior

surveys to cover a diverse array of contemporary environmental subjects pertinent to the Portuguese context (DeChano, 2006; Spínola, 2015). The final evaluation of environmental knowledge is based on the number of correct responses provided, with a proficiency benchmark set at 75% following the criteria outlined by Geiger et al. (2019).

To gauge environmental attitudes, a Portuguese version of the 15-item revised New Ecological Paradigm (NEP) devised by Dunlap et al. (2000) was used. Participants rate the items using a 5-point Likert-type scale, ranging from "never" to "always." A satisfactory level of internal consistency for the scale was indicated by a Cronbach's alpha of 0.74 obtained for the current NEP dataset (Nunnally & Bernstein, 1994). An overarching attitudinal score was computed, with potential scores falling within a spectrum of 15 to 75. Lower aggregate scores denote less favorable pro-environmental attitudes.

Behavior concerning the environment was evaluated using 23 items adapted from Kaiser (2020) and Spínola (2015). A 5-point Likert-type scale, ranging from "never" to "always," was utilized to assess the frequency of pro-environmental behaviors.A moderate level of internal consistency for the scale was indicated by a Cronbach's alpha of 0.65 obtained for the present behavioral dataset (Nunnally & Bernstein, 1994). Elevated totals on the sum of the 23 items correspond to more favorable pro-environmental behaviors, with potential scores ranging from 23 to 115.

A stratified sampling approach was used to select participants from all undergraduate courses at Algarve University. These courses were grouped into 7 main scientific areas: engineering, humanities, social sciences, natural sciences, agronomic sciences, formal sciences, and medical sciences. To achieve a 99% confidence level with a 2.5% margin of error, minimum sample sizes for the total population (n=251) and each scientific area were calculated. To recruit participants, at the start of the 2023-24 academic year, the researcher contacted teachers to schedule visits to their classrooms. Upon arrival, the researcher explained the project's objectives and invited students to participate. Data collection across different courses continued until the minimum sample size was reached for each scientific area.

The sample consists of 451 participants who are first-year undergraduate students at Algarve University. Among them, 65% are female, and 93% hold Portuguese nationality. The mean age of the participants is 19.8 ± 5.1 years old.

The data were analyzed to determine the levels of the main outcome variables. Descriptive statistics, including measures of central tendency, were calculated, and Cronbach's Alpha was utilized to assess the reliability of the scales. Correlations were computed between and among the outcomes and sociodemographic variables. Non-parametric tests, specifically the Kruskal-Wallis test, were employed to identify significant differences among and between groups of participants based on gender, family income, parents' literacy, course scientific areas, students' previous grades, and engagement in environmental education projects and activities. The analyses were conducted using IBM SPSS Statistics version 22.

3. Results

The mean total score for environmental knowledge obtained for the present sample of first-year higher education students corresponds to approximately 69% of correct answers, which falls below the criterion level for proficiency in environmental knowledge. The mean score of 73.7 was obtained for Pro-environmental Behavior, representing about 64% of the maximum scale score. For Attitudes towards the environment, the sample has a mean value of 58.0, indicating a positive pro-environmental attitude. Significantly positive correlations were found among the outcome variables: Knowledge with Attitudes ($r=0.44$), Knowledge with Behaviors ($r=0.25$), and Attitudes with Behaviors ($r=0.19$). Table 1 summarizes these findings.

Table 1. Descritive statistics for outcome variable (N= sample size; Minim=Minimum value; Maxim= Maximum value; Mean=Mean value; SD=Standard deviation)

	N	Minim	Maxim	Mean	SD
Environmental Knowledge	451	0	37	26.7	5.8
Proenvironmental Behavior	451	13	102	73.7	8.7
Proenvironmental Attitudes	448	27	75	58.0	7.2

In the present sample, gender was not found to be significantly associated with environmental knowledge. However, gender showed a significant correlation with attitudes ($r=0.34$) and behaviors ($r=0.15$). Female students exhibited significantly higher scores in pro-environmental attitudes and behaviors compared to male students ($p<0.001$ and $p=0.007$, respectively).

The majority of students reported having a family income that allows them to live reasonably comfortably (90%), and no correlations were found between family income and the outcome variables.

Regarding parents' literacy, mother's literacy was not found to be associated with the outcome variables. However, results indicated that father's literacy is associated with students' environmental knowledge and behaviors. Specifically, students with a father who holds a PhD degree (2% of them) are significantly less knowledgeable about the environment ($p<0.001$) compared to students whose fathers have any other level of literacy. Similarly, this group of students exhibited significantly less environmentally responsible behavior ($p=0.031$) compared to students with fathers who have graduated from college (26% of the sample).

According to students' previous school grades, approximately 70% of the participants fell into the middle of the scale, indicating they were good students, while 20% achieved scores in the very good and excellent ranges. Student's grade was found to significantly correlate with environmental knowledge ($r=0.33$), attitudes ($r=0.25$), and behavior ($r=0.16$). Results from the

Kruskal-Wallis test suggested significant differences in knowledge and attitudes among student groups categorized by grade. Specifically, students with good and very good grades were significantly more knowledgeable and had higher attitudinal scores compared to other groups ($p < 0.001$).

Significant correlations were observed between students' course scientific areas and their attitudes towards the environment ($r = 0.23$). Differences were also found among students from different study areas in terms of knowledge ($p < 0.001$), attitudes ($p = 0.022$), and behaviors ($p < 0.001$). Specifically: Engineering and humanities students displayed significantly higher levels of environmental knowledge compared to those studying social sciences ($p < 0.001$), natural sciences ($p < 0.001$), or medical sciences ($p = 0.005$); Students from natural sciences exhibited higher scores in pro-environmental behaviors compared to those from social sciences ($p < 0.001$), engineering ($p = 0.002$), or medical sciences ($p < 0.001$); Formal sciences students had higher attitudinal scores compared to humanities students ($p = 0.017$).

Participants who are or have been members of pro-environmental organizations (about 10% of the sample) scored significantly higher in pro-environmental behaviors than others ($p < 0.001$). However, participation in environmental education activities did not correlate with the outcomes.

4. Discussion

According to the present results, the mean levels of environmental knowledge among first-year Portuguese higher education students are above the criterion level typically considered satisfactory. However, these levels are similar to results obtained for students in the final stage of secondary school in different countries (e.g., DeChano, 2006; Negev et al., 2008). The attitudinal scores obtained for this sample of students could be considered as indicative of pro-environmental attitudes, and they are slightly higher than those reported in other studies (i.e., DeChano, 2006). The moderately pro-environmental behaviors observed in this study suggest that students' performance in behaviors is lower compared to their knowledge and attitudes. It is known that some ecological behaviors are easier to carry out than others (Kaiser & Wilson, 2000), and perceived behavior may appear negatively associated with actual behavior (Arnold et al., 2018).

In general, the present findings don't suggest increased weaknesses in environmental literacy among Portuguese university students, unlike prior studies (e.g., Fonseca et al., 2018). They reveal a connection between students' academic fields and their pro-environmental attitudes. In Portugal, environmental education has typically been integrated into specific subjects like biology and geography (Tracana et al., 2002). However, the results didn't show a clear pattern regarding the link between academic disciplines and environmental literacy. Engineering and humanities students tended to show higher knowledge levels, while those in natural sciences

displayed more pro-environmental behavior, and formal sciences students exhibited stronger attitudes. The evidence regarding the association between environmental literacy and students' prior curriculum-based environmental education is inconclusive. Environmental education has primarily focused on younger students, and as they progress, their involvement in environmental initiatives tends to decline (Schmidt et al., 2010, 2011). The current results confirm that Portuguese university students are presently less engaged in environmental endeavors compared to earlier years. This reduced engagement as students advance academically might contribute to the less favorable outcomes observed in pro-environmental behavior. While engagement in environmental education activities didn't correlate with environmental knowledge, attitudes, and behavior in this study, membership in pro-environmental organizations was significantly associated with pro-environmental behavior. This emphasizes that involvement in environmental activities can influence pro-environmental behavior.

The results indicated that student grade correlates positively with environmental knowledge, attitudes, and behavior, suggesting that students with good and very good grades tend to be more knowledgeable and have higher attitudinal scores. Additionally, fathers' literacy appears to be associated with students' environmental knowledge and behavior. Interestingly, family income did not impact the levels of environmental literacy in the studied students, contrary to findings by Negev et al. (2008), who found an association between knowledge and family socioeconomic status. Moreover, the present results also indicated gender differences in pro-environmental attitudes and behaviors. This aligns with a recent meta-analysis by Gökmen (2021), which suggests that gender affects environmental attitudes in favor of females at a low level. This observation was consistent with the present sample of Portuguese higher education students.

As expected, the results indicated moderate relationships between environmental knowledge and pro-environmental attitudes, supporting the hypothesis that environmental knowledge is positively correlated with environmental attitudes (e.g., Geiger et al., 2018). Additionally, positive correlations were observed between environmental knowledge and behaviors, as well as between attitudes and behaviors, although these correlations were weak. This finding is not unusual and is consistent with previous studies (e.g., DeChano, 2006; Negev et al., 2008). The results could contribute to discussions about formal environmental education in secondary schools and the promotion of formal and non-formal environmental education in Portuguese higher education institutions, aiming to enhance students' environmental literacy and citizenship.

Acknowledgments

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