Educating for the future: How higher education in environmental management affects pro-environmental behaviour

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ABSTRACT

This study analyses whether and how environmental education determines the adoption of pro-environmental behaviours. We conducted an experiment on 222 business administration students to examine this relationship from two theoretical approaches: instrumental and emancipatory perspectives. Structural equation modelling shows that environmental education in higher education affects pro-environmental behaviour, but only in an indirect way, i.e., through the knowledge–concern–willingness model. These results confirm the emancipatory perspective of higher environmental management education in detriment of instrumental counterpart. Thus, this research sheds light on the current theoretical debate around both perspectives and it offers important implications for both educators and policy makers in designing business educational programmes.

1. Introduction

Environmental education has historically been an effective mechanism to fight against environmental degradation through the change of knowledge, concerns and behaviours of individuals. During last years, this degradation has become more salient, being remarkable examples the current levels of deforestation (RTL Today, 2021), the quantity of plastic waste into the oceans (The Guardian, 2020) or the dangerous consequences of climate change (Insurance Journal, 2021; The New York Times, 2021). This situation has incremented the need of an environmental education that rises awareness about the critical environmental situation, awakens human concern and drives the correction of individual habits and behaviours.

Organisations' response to environmental problems intensification is reflected through the implementation of cleaner production actions (Awan et al., 2020a), such as environmental pollution prevention (Awan et al., 2020b), transition to more energy-efficient technologies (Cheng et al., 2021), or the circular economy strategies (Garcés-Ayerbe et al., 2019a). Management scholars increasingly recognise that involvement of individual agents is a must. Social individual actors related to the organisations, such as shareholders, CEOs, middle and upper level of managers, employees or consumers dictate decisions, recommendations, and they have behaviours that affect clean production systems (Murillo-Luna et al., 2008; Aguilera et al., 2021; Bueno-Garcia et al., 2021; Dhir et al., 2021). In this sense, management literature supports the influence of managers' beliefs and behaviour on corporate social and environmental responsibility (Sharma, 2000; Lewis et al., 2014; Gröschl et al., 2017; Tang et al., 2018; Yang et al., 2019; Zhou et al., 2021; Wernicke et al., in press). The role of employees toward corporate sustainability has also been recently evidenced (De Stefano et al., 2018; Delmas and Pekovic, 2018). In this vein, and within a micro-foundational perspective, Bueno-García et al. (2020) and Bueno-Garcia et al. (2021) reveal the influence of shareholders on the firms' environmental proactivity. The relevance of customers and consumers' behaviour in achieving sustainability goals has also been highlighted in recent literature (Murillo-Luna et al., 2008; Dhir et al., 2021). Recently, Garcés-Ayerbe et al. (2019b) offer indicative empirical evidence that communication and cooperation among various organisational agents

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(employees, suppliers, clients, competitors, technological centres, …) enhance cleaner production in the organisations. From a practical point of view, this key role of individuals over sustainability in organisations can be exemplified by the 2021 letter of BlackRock[1] Chairman, calling them to address stakeholders' needs and focus on the climate change emergency to create a long-lasting value.

Since firms' environmental impact traces back to individual actors, the study of their pro-environmental behaviour and its determinants has been of a great interest for the environmental literature (for a literature review in this respect, see: Hines et al., 1986; Bamberg and Möser, 2007; Klöckner, 2013). This amount of wisdom focuses on individual behaviour as a possible solution to offsetting the destruction of the natural environment (Wu et al., 2020). Environmental education, as a mechanism capable of improving the personal and professional behaviour of individuals (Wals et al., 2008; Earle and Leyva-de la Hiz, 2020), thus acquires a prominent role.

Pro-environmental behaviour has been studied from two main psychological perspectives: The *Theory of Reasoned Action* (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) and the *Theory of Planned Behaviour* (TPB) (Ajzen, 1991). Following these theoretical approaches, some studies have proposed specific pro-environmental behavioural models focused on analysing the determinants needed for a behavioural change towards pro-environmental actions (Bang et al., 2000; Klöckner, 2013; Russell et al., 2017; Li et al., 2019). Environmental education has been assiduously considered as one of these key determinants (Zsóka et al., 2013; Earle and Leyva-de la Hiz, 2020; Hansmann et al., 2020). Even some platforms, such as Principles for Responsible Management Education (PRME), motivate the rise of sustainability in higher education institutions.

The way environmental education affects pro-environmental behaviour has been analysed from two different perspectives. On the one hand, the instrumental perspective presumes that the role of environmental education is to change the pro-environmental behaviour of target groups (Wals et al., 2008). This perspective views environmental education as a tool for changing public behaviours and perspectives (Fischer and Barth, 2015), and has faced strong academic criticism for regarding education and learning as a means to a given end, and for treating target groups as passive recipients of information (Wals et al., 2008; Barth, 2012). On the other hand, the emancipatory or intrinsic approach focuses on creating opportunities for promoting independent thinking, active dialogue, and autonomous action plans (Wals et al., 2008). In this way, current academic debate still discusses whether environmental education should fall into one perspective or the other. That is, to educate *about* sustainable development (instrumental perspective), which is also a transmissive way of educating environmental issues, or to educate *for* environmental issues, (emancipatory perspective), also characterised by being transformative, participative and constructive (Wi and Chang, 2018; Cincera et al., 2019, 2020; Earle and Leyva-de la Hiz, 2020).

For all the aforementioned reasons, the study's main objective is to analyse whether environmental education affects pro-environmental behaviour of future organisational agents. By doing so, we simultaneously analyse the effect of higher education in environmental management on pro-environmental behaviour from two perspectives: instrumental and emancipatory. This approach helps us conclude the sequence through which environmental education affects pro-environmental behaviour. As noted, there is still a gap in the literature related to whether the best environmental education approach is the instrumental or emancipatory perspective. Although it seems that most education studies conclude that the emancipatory approach is the best way to engage environmental education (Al-Naqbi and Alshannag, 2018; Whitley et al., 2018; Tolppanen et al., 2020), to the best of our

knowledge, in the previous literature no empirical model has previously tested both perspectives together.

Therefore, the contribution of this study is threefold. First, we contribute to existing debate in the literature regarding the impact of environmental education on pro-environmental behaviour from two different perspectives. Second, we also contribute to the pre-existing debate about implementing sustainable environmental courses in higher education institutions. Finally, we contribute to the existing theoretical literature by joining together the psychological approach, i. e., the knowledge-concern-willingness model with the educational perspective, i.e., emancipatory versus instrumental perspectives.

In order to confirm whether and how higher education environmental management education affects pro-environmental behaviour, we first analyse the theoretical framework around the issue in section 2. Consequently, we review the theoretical framework of pro-environmental behaviour theories and the current debate surrounding the two main approaches to environmental education, presenting our hypotheses with regard to the knowledge-concern-willingness proposed model and the direct effect in pro-environmental behaviour. The third section presents the experimental design and the statistical methodology used in this study. We present the results in section 4 and discuss them in relation to previous literature in section 5. The theoretical and practical implications and conclusions of the research are presented in sections 6 and 7.

2. Theoretical framework

2.1. Testing pro-environmental behaviour theories

Pro-environmental behaviour can be defined as a set of actions used consciously and altruistically to protect the environment either by taking measures to reduce the negative environmental impact of actions or by taking steps to improve the environment (Stern, 2000; Kollmuss and Agyeman, 2002; Steg and Vlek, 2009; Onel and Mukherjee, 2016). Most authors agree that one key variable for defining environmental behaviour is intentionality (Rivera-Torres and Garcés-Ayerbe, 2018). There is a wide variety of environmentally friendly practices variously classified in the literature. For instance, Jimenez and Lafuente (2010) distinguish three types of actions depending on the intentionality and intensity of one's actions. Stern (2000), however, claims that *pro-environmental behaviour* must be conscious and intentional and distinguishes between public and private sphere environmental behaviour. Song and Soopramanien (2019) distinguished between high- and low-effort behaviour. Walker et al. (2015) used the individual versus collective categorisation, and Takahashi and Selfa (2015) used a multi-item scale. Although there are many different classifications, the intentionality variable features in a large proportion of these classifications.

Pro-environmental behaviour has been studied using two main theoretical approaches, both of which revolve around intentionality: the *Theory of Reasoned Action* (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) and the *Theory of Planned Behaviour* (TPB) (Ajzen, 1991). The TRA was developed to better understand attitudes (which reflect intentionality) and behaviour (Ajzen and Fishbein, 1980). This theory suggests that intentionality or willingness to act, which ultimately results in behaviour, is based on individual attitudes and social norms. Based on this approach, pro-environmental behaviour depends on the individual's willingness to act and the conscious control of their behaviour and not, therefore, on free will. The TPB, developed by Ajzen (1991) as a complement to the TRA, presumes that behavioural intentions are determined by attitudes towards a particular behaviour: subjective norms, which are forms of social pressure to perform a given action; and perceived behavioural control over a given action. In this regard, attitudes are described as the result of rational choice-based evaluation, positive or negative, of the consequences of a given behaviour, together with an estimate of the likelihood of different outcomes (Ajzen, 1991). Subjective norms are a function of normative beliefs and

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[1] BlackRock is the world's largest asset manager, with $8.67 trillion in assets under management as of January 2021 (Hansen, 2021).

the motivations to comply with these beliefs (Ajzen, 1991); perceived behavioural control is related to access to the necessary resources and opportunities to perform a certain behaviour (Ajzen, 1985). As such, individuals will adopt pro-environmental behaviours if they perceive the consequences of their actions (for instance, avoiding a fine or receiving a reward), and their environmental behaviours will also depend on how they perceive their own ability to undertake environmentally friendly actions.

Based on the TRA and TPB theoretical approaches, various authors have put forward specific environmental behavioural models. For example, Hungerford and Volk (1990) proposed a sequential linear model that begins with 'entry-level variables,' follows with 'ownership variables,' and finishes with 'empowerment variables.' The first variables refer to individual interest in environmental issues; the ownership variables highlight the importance of knowledge about environmental issues and the possible consequences – positive or negative – of environmental behaviour; the last set of variables account for the locus of control and intention to act. Also, Stern et al. (1999) proposed the value-belief-norm theory, which suggests that individuals need to value the protection of the natural environment because they understand its benefits for humanity. They also need to understand environmental issues to be aware of and understand the possible consequences of human actions on the environment. A year later, Stern (2000) presented the *Theory of Environmentally Significant Individual Behaviour* (TESIB). In line with his previous work, Stern outlines four types of variables that affect pro-environmental behaviour: 1) *attitudinal factors*; that is, the individual's willingness to adopt environmentally friendly actions; 2) *contextual forces*, including propaganda, regulation, legal and institutional factors, and financial incentives; 3) *personal capabilities*, which include knowledge, skills, and available resources (money, time, social status, and power); and 4) *habit and routine,* because behavioural changes generally involve replacing established habits. Moreover, Bang et al. (2000) proposed a concern–knowledge–beliefs model to analyse the action of paying a premium or extra cost for using renewable energy – considered a pro-environmental action – arguing that individual environmental concerns failed to translate into a better understanding of renewable energy. More recently, Rivera-Torres and Garcés-Ayerbe (2018) have singled out three factors that determine individual pro-environmental commitment by measuring the frequency of environmentally friendly actions undertaken by the individual: cognitive determinants, affective determinants, and dispositional determinants. Cognitive determinants refer to the individual's understanding of environmental issues and their consequences, affective determinants refer to levels of affection for and concern about the natural environment, and dispositional determinants refer to individual willingness to invest effort and resources into protecting the natural environment. In the same way, Nguyen et al. (2021) distinguish between three environmental factors that act as main drivers of pro-environmental behaviour: knowledge, attitude, and intention. Following the TPB theoretical approach, Hansmann et al. (2020) used four psychological determinants of pro-environmental behaviour used in four singled direct effect models: subjective norms, i.e., behavioural expectation; behavioural control; attitude and; identity (see also Han, 2021 for a recent review of different pro-environmental behaviour models using the TRA and TPB theoretical perspectives). Although these models differ, there seems to be some consensus concerning the key variables as far as environmental behaviour is concerned: understanding environmental problems, environmental concern and guilt (that is, so-called 'moral norms') (Bamberg and Möser, 2007), and evaluation of the possible outcome of actions (Ajzen and Fishbein, 1980; Ajzen, 1991; Hines et al., 1986).

Taking all of this into consideration, our study proposes a model based on the TRA and TPB approaches: the knowledge–concern–willingness model of pro-environmental behaviour. This model considers the three groups of determinants proposed by Rivera-Torres and Garcés-Ayerbe (2018) – cognitive, affective, and dispositional – but goes a step further by analysing their logical sequence.

Following the TRA, an increase in environmental knowledge positively affected environmental attitudes (Milfont and Duckitt, 2010; Grebitus et al., 2020). Although some authors have differentiated between environmental concern and attitude (Schultz et al., 2004; Stern and Dietz., 1994), others have used environmental concern to refer to environmental attitudes (Van Liere and Dunlap, 1981; Faccioli et al., 2020). In this study, we follow the second approach, and we define environmental concern as 'the degree to which people are aware of and support efforts to solve problems regarding the environment and or indicate the willingness to contribute personally to their solution' (Dunlap and Jones, 2002, p. 485). From the TRA perspective, we suggest that as a first step to change an individual's environmental behaviour, they must increase their environmental knowledge, defined as the general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems (Fryxell and Lo, 2003, p. 48). That is, when individuals increase their knowledge about environmental issues, they increase their environmental concern related to environmental consequences. John-Heeren et al. (2020) found this environmental knowledge to have a positive effect on environmental concern in a sample of adolescent individuals. Also, Polonsky et al. (2012) achieved similar results, suggesting that when individuals become more knowledgeable about environmental issues, they modify their environmental concern about environmental impact. Thus, we propose the first hypothesis:

H1. Environmental knowledge has a direct and positive effect on environmental concern.

Based on the definition proposed by Dunlap and Jones (2002), environmental concern precedes environmental awareness because concern indicates the willingness to contribute to the solution of environmental problems. Regarding this idea, some studies have explained environmental willingness as an expression of environmental concerns (Milfont and Duckitt, 2010; Zhang and Biao, 2021). The so-called self-concept (Minton and Rose, 1997) explains the direct relationship between environmental concern and environmental willingness or intention. This concept reflects the sense of moral obligation that leads an individual to carry out a given action or adopt a given behaviour triggered by his/her willingness to act in response to personal values. Therefore, being concerned about the environment and being willing to act pro-environmentally means acting according to the person's own values (rational-choice-based evaluation; Ajzen, 1991). Thus, we hypothesised as follows:

H2. Environmental concern has a direct and positive effect on environmental willingness.

Finally, intentionality or willingness to act directly precedes behaviour (Ajzen and Fishbein, 1980). Both theoretical approaches, the TRA and TPB, underline the importance of intentionality –as an individual attitude-as a determinant of an action to start or not (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Ajzen, 1991). These approaches explain that, based on the evaluation of expected results, attitudes drive individuals' actions. Thus, we consider that environmental willingness is the factor that determines whether an individual will undertake environmental action or not, which makes it a key factor in the analysis of individual pro-environmental behaviour (Jimenez and Lafuente, 2010; Rivera-Torres and Garcés-Ayerbe, 2018; Steg and Vlek, 2009; Venhoeven et al., 2016; Zhu et al., 2020). In this sense, we propose the following hypothesis graphically summarized in Fig. 1:
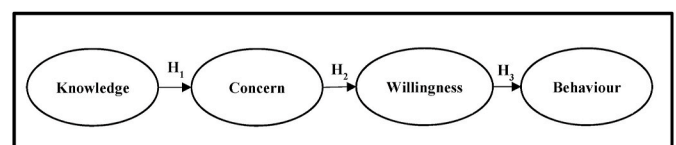

Fig. 1. Pro-environmental behaviour model.

H3. Environmental willingness has a direct and positive effect on environmental behaviour.

2.2. Extending theory: effect of environmental education on pro-environmental behaviour

Environmental education has been analysed through two different approaches: On the one hand, the *instrumental perspective* presumes that the role of environmental education is to change the pro-environmental behaviour of target groups (Wals et al., 2008). This perspective views environmental education as a tool for changing public behaviours and perspectives (Fischer and Barth, 2015), which is considered a transmissive way of educating environmental issues (Cincera et al., 2019). The *emancipatory or intrinsic approach*, in contrast, focuses on creating opportunities for positive development and promoting autonomous thinking, active dialogue, and autonomous action plans (Wals et al., 2008): that is, the emancipatory perspective revolves around empowerment and the self-governing individual and is characterised by developing skills to critically appraise expert opinions and explore the inherent contradictions of sustainable living and learning as (and not for) sustainable development (Vare and Scott, 2007; Wals et al., 2008). Some authors, such as Fischer and Barth (2014), see environmental education as a means for helping the individual to cope with different demands without establishing a rigid code of behaviour or valid choices. This approach views the individual as an autonomous entity who takes part in an interactive dialogue about social targets and possible development paths (Barth, 2012). Hence, although the instrumental approach is based on a normative socio-political concept of sustainable development for environmental education that regards sustainability as a target to which education can contribute, the emancipatory approach focuses on the educational aspects (Fischer and Barth, 2015). In this way, current academic debate still discusses whether to include environmental education in one perspective or the other to achieve sustainability (D'Amato and Krasny, 2011; Monroe et al., 2013; Cincera et al., 2019, 2020). Then, the question of whether to educate *about* sustainable development or to educate *for* environmental issues remains unclear.

As early as the 1990s, Hungerford and Volk (1990, p. 9) referred to the relationship between environmental education and environmental behaviour in the following way: '*if we make human beings more knowledgeable, they will, in turn, become more aware of the environment and its problems and, thus, be more motivated to act towards the environment in more responsible ways.*' Years later, they refined this argument, claiming that the model that analyses the relationship between environmental education and environmental behaviour is a complex one that involves knowledge, cognitive abilities, psychological characteristics, and attitudes (Hungerford and Volk, 2003). This argument, supported by authors such as Cotton et al. (2007) who emphasised the need for environmental education to reach beyond the generation of knowledge, also encourages the generation of environmental concerns and skills to contribute to social change. It is clear that these authors refer to the emancipatory approach of environmental education where the change of pro-environmental behaviours is not the main target but that the focus is set on knowledge, skills, and competences. However, these factors can also contribute to change the environmental behaviour of individuals, as previously noted.

Although the debate about the role environmental education plays in changing environmental behaviour is ongoing (Al-Naqbi and Alshannag, 2018; Whitley et al., 2018; Faize and Akhtar, 2020; Tolppanen et al., 2020), empirical studies have yielded no conclusive results to date. For example, Mangas et al. (1997) examined the impact of environmental education through a so-called research-action study, which essentially involves comparing student answers to a survey before and after exposing the students to a course in environmental education. Although no impact on environmental behaviour was detected, the authors identified an increased awareness of environmental problems and a surge in environmentally friendly values. Monroe et al. (2013),

alternately, found environmental education to directly affect environmental behaviour. They explored how agency-sponsored adult educational programmes encourage individual and collective change, and they found that the educational programme helped communities change their perspective on firefighting, pass regulations that restrict individual property rights, and empower residents to reduce wildfire risks. Sales-de-Aguiar and Paterson (2018) applied a real-world problem to an experiment carried out in a Scottish university whose syllabus incorporated sustainability courses into the undergraduate accounting degree. The authors collected data through questionnaires and demonstrated an increase in awareness and a positive response towards sustainability among all participating groups, leading to changes in individual behaviour. More recently, Sidiropoulos (2018) analysed the impact of introductory sustainability seminars and regular curricular items in higher-education institutions in Australia, Italy, and Malaysia. The study monitored changes in the attitude of students enrolled in non-compulsory sustainability courses during the period 2013–2015. The results suggest that environmental education emphasises the links between humans and nature, which, according to the author, can reinforce more environmentally friendly values and behaviours, although it does not trigger them outright. Wu et al. (2020) analysed the effect of autobiographical memory function, a specific environmental education programme. Their results suggest that this programme directly affects environmental behaviour, among other environment-related factors such as awareness and knowledge. In the same way, Faize and Akhtar (2020) explored the effect of scientific argumentation in relation to undergraduate students' environmental education under the experimentation methodology. The results show that environmental education positively affects environmental knowledge and environmental attitudes, and, although the authors agree with the subsequent effect on environmental behaviour, this effect remains not empirically tested under this methodology.

Following previous studies and the aforementioned arguments, we could expect two different relationships between environmental education and pro-environmental behaviour. As we have argued, based on the instrumental approach, environmental education may be seen as a means of reaching a change in environmental behaviour, and therefore we could expect a direct positive relationship between both elements. Furthermore, based on the emancipatory approach and following the proposed knowledge–concern–willingness model, we could expect an indirect positive effect of environmental education on pro-environmental behaviour. Thus, we present the following hypotheses, which is also summarized on Fig. 2:

H4. Environmental management education has a direct positive effect on pro-environmental behaviour.

H5. *Environmental management education has an indirect positive effect on pro-environmental behaviour through the knowledge–concern–willingness model.*
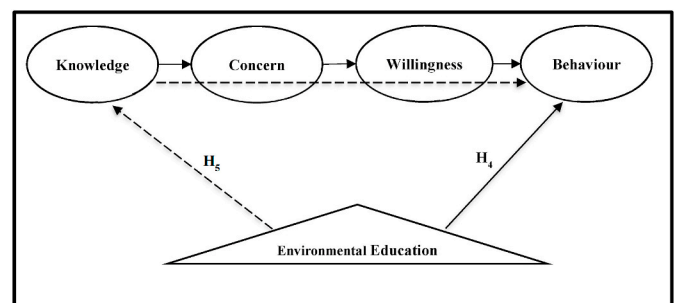

Fig. 2. Theoretical framework and hypotheses.

3. Methods

3.1. Experimental design

In order to test the hypotheses, we designed a *between-groups* experimental setup comprising business administration students from Spain and France. We only exposed one group of students in each country to an environmental management course, the Environmental Group (EG), whereas we referred to the unexposed group from both countries as Control Group (CG). Fig. 3 illustrates the design and development of the experiment in detail. We followed a methodology of 'experimental intervention' in three steps (Cohen et al., 2002). The first step took place at time 0, before the configuration of the sample, and consisted of an initial measurement (O_0) utilising a questionnaire presented to all participants (groups EG and CG). This questionnaire included questions concerning self-reported views about cognitive, affective, dispositional, and behavioural variables. The second step consisted of exposing the EG to specific training on environmental management. The third step, at time 1, involved asking participants in both groups to respond to the same questionnaire presented at time 0. Finally, these results were processed and measured (O_1). During measurements, participants had access to a member of the research team at all times, who addressed any doubts concerning the questionnaire. We emphasised that the questionnaire did not have correct or incorrect responses, and that it was anonymous, mitigating social desirability bias and guaranteeing the quality and honesty of the answers (Krumpal, 2013; Nederhof, 1985; Ong and Weiss, 2006).

The questionnaires were designed and distributed using the Qualtrics Research Core tool, which allows answers to be collected through different platforms and compiles important data concerning the reliability of questionnaires. In this regard, and given the nature of the method used, only the responses of participants who had successfully completed questionnaires on both occasions (times 0 and 1) were considered valid. Questionnaires that were filled out unusually fast (−50% of the average of 682 s) or with too many answers missing (more than 30% of the total items/questions) were ruled out. A total of 47 invalid observations were withdrawn for these reasons, as they indicate that the participant did not pay enough attention to the questionnaire. In order to match both rounds of answers while maintaining participant anonymity, Qualtrics assigned a random code to each participant in the first survey, and this random number was required to fill out the second survey.

The experiment exposed the EG to a four-month course on environmental management applied to business management; this course, delivered by the authors who teach students from both the EG and the CG in different subjects, is already part of the university curriculum. In both Spanish and French universities, the environmental management course aims to introduce students to the current political and institutional setting concerning environmental management, thus making them understand that these environmental requirements are a core strategic factor in business administration. In addition, the module aims to provide students with the necessary knowledge to decide when and how to introduce and develop environmental management measures, tools for pollution prevention and control, and environmentally friendly organisation and communication tools. For more information about experimental intervention, see Appendix B, which includes a detailed syllabus of the course.

In addition, we carried out post hoc analysis, which includes the environmental education variable (EE), which has a value of 1 for EG students and a value of 0 for CG students. The lecturers who imparted the course were not informed about the research hypotheses and the experimental design in order to avoid bias. Also, the members of the research team who handled data analysis were not in direct contact with participants. In order to isolate the results of the course and avoid country bias as much as possible, a dichotomous control variable COUNTRY was also included: this variable has a value of 0 for French respondents and 1 for Spanish respondents.

3.2. Participants

The final sample consisted of 222 final-year business and management administration students[2] in two universities in Spain and France, two countries with similar sociocultural profiles. Consulting students from two different universities expanded the sample and avoided the bias that may result from questioning students with the same educational background. In both cases, the environmental management course is part of the official curriculum recognised by the European Higher Education Area. Although participants were encouraged to participate, their participation was voluntary. They were not informed about the nature of the experiment, the research aims, or the experimental design until after they had answered both questionnaires in order to minimise bias. Table 1 presents a detailed description of the number of participants per country and other relevant descriptive variables. The proportion of valid questionnaires was similar in both countries, as was the distribution of participants by age and sex. Pearson Chi-Square tests for differences between observed frequencies show that the EG and the CG distributions in terms of sex (2.08) and age (2.58) were not statistically significant (p > 0.05), thus guaranteeing demographic homogeneity across the board.

3.3. Measures

All items were measured on a 0–10 *Likert* scale, where 0 indicates that the respondent totally disagrees with the statement presented in the questionnaire and 10 represents that the respondent totally agrees with the statement. The use of 11-point scale ranges is increasingly common in the fields of environmental management (e.g., Rivera-Torres et al., 2015), higher education (e.g., McGarr and Clifford, 2013) and environmental education (e.g., Walsh-Daneshmandi and MacLachlan, 2006) because they provide a greater variety of answers and are empirically more reliable. The scale is also compatible with the marking systems used in Spanish (0–10) and French (0–20) universities, making the answers more intuitive for participants.

Designed to measure our target variables through various self-reported items, we based the questionnaire (see Appendix A) on the

Time 0	Treatment	Time 1
O_{0-EG}	Environmental Education	O_{1-EG}
O_{0-CG}		O_{1-CG}

Development

O_{0-EG}: Initial Measurement for Environmental Group
O_{1-EG}: Final Measurement for Environmental Group
O_{0-CG}: Initial Measurement for Control Group
O_{1-CG}: Final Measurement for Control Group
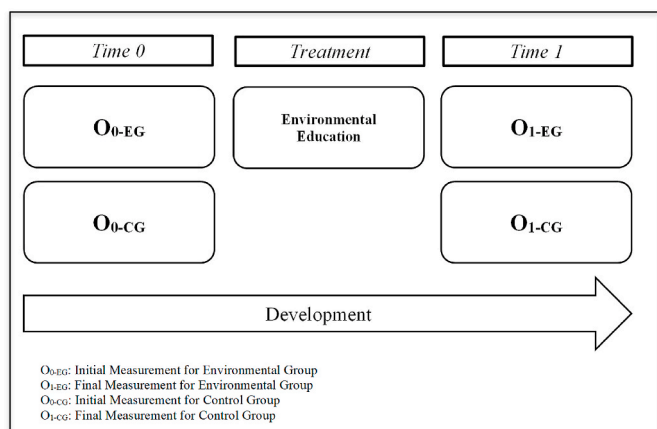
Fig. 3. Experimental design.

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[2] The experiment was presented to the ethics and data protection offices of both universities involved in the study, which authorised the experiment and decided that no further protection measures were to be adopted since the study does not collect personal data and the data was to be analysed in bulk and for research purposes only. Students were informed of this decision, and they signed an informed consent form before answering the first survey in time 0.

Table 1
Demographic characteristics of the experimental units.

	EG		CG	
	N	%	N	%
Spain (N = 122)				
Gender				
Female	53	55.2	12	46.2
Male	43	44.8	14	53.8
Age				
18–25 years	92	95.8	24	92.3
26–30 years	4	4.2	2	7.7
France (N = 100)				
Gender				
Female	45	54.9	9	50
Male	37	45.1	9	50
Age				
18–25 years	82	100	17	94.4
26–30 years	0	0	1	5.6
Total (N = 222)				
Gender				
Female	98	55	21	45.6
Male	80	45	23	54.4
Age				
18–25 years	174	97.7	41	93.2
26–30 years	4	2.3	3	6.8

existing literature: knowledge (Janmaimool, 2017; Jimenez and Lafuente, 2010; Rivera-Torres and Garcés-Ayerbe, 2018), concern (Garcés-Ayerbe et al., 2002; Jimenez and Lafuente, 2010; Rivera-Torres and Garcés-Ayerbe, 2018), willingness (Garcés-Ayerbe et al., 2002; Rivera-Torres and Garcés-Ayerbe, 2018), and behaviour (Janmaimool, 2017; Jimenez and Lafuente, 2010). Table 2 illustrates these four blocks, as well as the items used to measure each of them in the questionnaire, in detail. The first block relates to the cognitive dimension and includes three items that reflect the degree of individual knowledge about environmental problems (KNOW1 to KNOW3). The second block addresses the affective dimension and includes eight items related to concern for the environment and its preservation (CONC1 to CONC7). The third block relates to the dispositional dimension and includes five items that

Table 2
Constructs and items.

KNOWLEDGE	
KNOW1	*Major environmental problems*
KNOW2	*The main causes of environmental problems*
KNOW3	*The main solutions or mitigation measures for environmental problems.*
CONCERN	
CONC1	*Air pollution*
CONC2	*The pollution of the seas, rives, etc …*
CONC3	*Climate change*
CONC4	*Accumulation of residues*
CONC5	*Water scarcity*
CONC6	*The use of pesticides and chemical products*
CONC7	*Increase of temperatures worldwide*
WILLINGNESS	
WILL1	*Willingness to pay extra for more environmentally friendly products*
WILL2	*Willingness to pay extra taxes to protect the environment*
WILL3	*Willingness to change my daily habits to protect the environment*
WILL4	*Willingness to obey norms that restrict the use of private vehicles in urban areas*
WILL5	*Willingness to accept restrictions in individual residue generation*
BEHAVIOUR	
BEHA1	*Use separate containers for different types of recyclable product (e.g. glass, containers, paper, cardboard …)*
BEHA2	*Join pro-environment actions (clean parks, beaches, plant trees)*
BEHA3	*Buying products with minimal or recyclable packaging*
BEHA4	*Raise awareness among friends and relatives, and encourage them also to protect the environment*
BEHA5	*Collaborate with associations the main aim of which is to protect the environment*

indicate the willingness to undertake individual environmentally friendly actions (WILL1 to WILL5). The final block refers to the behavioural dimension and includes five items concerning practices related to pro-environmental behaviour (BEHA1 to BEHA5). These items were examined and endorsed by an expert panel, and a pilot test was conducted with a small group of students (who did not participate in the final study) to ensure that all of the different items in the questionnaire were easy to understand.

4. Results

4.1. Preliminary results

In order to present a preliminary perspective of results, and given the experimental nature of the study with two groups (EG group and CG group) and two time-moments for measurement (time 0 and time 1), we began by carrying out several t-tests for mean comparisons between groups and between time-moments. This methodology allows to determine if there are significant differences between groups in the times (independent-samples t-tests) and between times in the groups (paired-samples *t*-test) (Peters, 2001).

Table 3 presents the results of the t-tests of all items in each block, comparing averages between times (O_0 and O_1) and groups (EG and CG). No significant differences between groups at time 0 existed (i.e., the mean values for every questionnaire item are similar in both groups), which shows that participants' perceptions across both groups were similar at the beginning of the experiment concerning all four variables. Regarding our hypotheses 4 and 5, measurements show that between times 0 and 1, the EG values increased significantly in all knowledge- and behaviour-related items ($p < 0.00$) and most (3/5) dispositional items ($p < 0.10$). Although most concern-related values increased (6/8), they did so significantly only for variable KNOW1 ($p < 0.05$). No significant variation in any item or block was observed in the CG ($p > 0.05$). These results suggest that our experiment (i.e., to expose the students to an environmental management course) has significant positive effects on the self-reported levels of environmental knowledge, concern, willingness, and pro-environmental behaviour.

4.2. Post hoc analysis: the mediating effect of knowledge, willingness, and concern

Once we preliminarily confirmed the positive effects of EE in promoting environmentally friendly attitudes, we proceeded to undertake a post-hoc analysis in order to test our hypotheses. Owing to the data structure and the strong correlations between the different items (see Table 4), SEM appears to be the more suitable methodology for an in-depth statistical analysis of our experimental data. This methodology allows for the simultaneous analysis of the measurement model, integrating the correlated items in the construction of different constructs to measure every variable and interrelate these constructs in the structural model according to the theoretical model and its hypotheses.

In addition, SEM allows for the analysis of the mediation models concerning both direct and indirect effects in causal inference (Bollen, 1987, 1998, 1998). For the calculations, SEM Mplus 8 analytical software was used (Muthén and Muthén, 1998). Since the observable variables are represented utilising a 0–10 Likert scale, we presume that multivariate normality will not ensue (Rivera and Satorra, 2002). In this setting, we decided to use maximum likelihood parameter estimates with standard errors and chi-squared testing, which are statistically robust for non-normality (MLR) (Muthén and Muthén, 1998).

Table 5 presents the results at both times. One latent variable has been measured for each of the dimension's knowledge (KNOW), concern (CON), and willingness (WILL), whereas, following the existing literature, two latent variables have been measured for the behaviour dimension: basic (N1) and advanced (N2) (Rivera-Torres and Garcés-Ayerbe, 2018).

Table 3
Descriptive statistics of the items.

KNOWLEDGE	Means[c] – Standard Deviations (SD)								Means tests between:							
	O_{0-EG}		O_{0-CG}		O_{1-EG}		O_{1-CG}		Groups in the Times[a]: Control vs Environmental				Times in the Groups[b]: Time 0 vs Time 1			
									H0: O_{0-EG}=O_{0-CG}		H0: O_{1-EG}=O_{1-CG}		H0: O_{0-EG}=O_{1-EG}		H0: O_{0-CG}=O_{1-CG}	
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD								
KNOW1	6.66	1.71	6.95	1.54	7.67	1.48	7.22	1.53					−8.34	0.00	−0.73	*0.47*
KNOW2	6.58	1.66	6.30	1.65	7.39	1.41	6.59	1.57	−0.98	0.33	−3.08	0.00	−6.06	0.00	−0.57	*0.57*
KNOW3	5.37	1.87	5.81	1.78	6.97	1.53	6.39	1.43	1.43	0.15	−2.20	0.03	−10.07	0.00	−1.70	*0.10*
CONCERN																
CONC1	8.37	1.44	8.71	1.30	8.54	1.20	8.63	1.34	1.43	0.15	0.42	0.68	−1.99	0.05	0.64	*0.53*
CONC2	8.69	1.43	8.50	1.54	8.64	1.27	8.67	1.18	−0.77	0.44	0.18	0.86	0.51	0.61	−1.07	*0.29*
CONC3	8.45	1.63	8.43	1.74	8.48	1.47	8.42	1.42	−0.09	0.93	−0.25	0.80	−0.33	0.74	−0.35	*0.73*
CONC4	8.13	1.65	8.17	1.53	8.29	1.50	8.21	1.69	0.13	0.90	−0.31	0.76	−1.46	0.14	−0.29	*0.77*
CONC5	8.87	1.83	8.85	1.64	9.03	1.30	8.95	1.55	−0.07	0.95	−0.37	0.71	−1.43	0.16	−0.30	*0.76*
CONC6	7.90	1.86	8.07	1.50	7.98	1.62	7.56	1.85	0.58	0.57	−1.51	0.13	−0.75	0.46	1.46	*0.15*
CONC7	8.34	1.85	8.36	1.63	8.31	1.59	8.12	1.54	0.06	0.95	−0.71	0.48	0.13	0.90	0.70	*0.49*
WILLINGNESS																
WILL1	7.05	2.17	7.21	2.05	7.30	1.91	7.35	1.77	0.44	0.66	0.17	0.87	−1.88	0.06	−0.44	*0.66*
WILL2	6.02	2.63	6.53	2.76	6.65	2.37	7.02	2.05	1.14	0.26	0.95	0.34	−4.21	0.00	−1.23	*0.23*
WILL3	8.15	1.92	8.33	1.83	8.07	1.84	7.95	1.67	0.56	0.57	−0.39	0.70	0.69	0.49	1.28	*0.21*
WILL4	7.48	2.58	7.38	2.25	7.67	2.24	6.74	2.27	−0.25	0.80	−2.45	0.02	−1.43	0.15	2.29	***0.03***
WILL5	7.74	2.14	7.49	2.26	8.02	1.85	7.30	1.85	−0.69	0.49	−2.30	0.02	−1.79	0.08	0.36	*0.72*
BEHAVIOUR																
BEHA1	7.13	2.94	7.64	2.54	7.62	2.31	7.22	2.50	1.06	0.29	−0.99	0.33	−3.07	0.00	1.14	*0.26*
BEHA2	2.79	2.68	3.05	2.73	3.54	3.04	3.40	2.94	0.51	0.61	−0.27	0.79	−3.05	0.00	−0.67	*0.51*
BEHA3	4.87	2.55	5.38	2.54	5.46	2.43	5.79	2.28	1.17	0.24	0.82	0.41	−2.96	0.00	−0.97	*0.34*
BEHA4	5.29	2.90	5.62	2.83	6.07	2.66	5.80	2.60	0.66	0.51	−0.58	0.56	−4.25	0.00	−0.20	*0.84*
BEHA5	3.41	3.24	3.14	2.97	4.04	3.19	3.93	3.20	−0.48	0.63	−0.20	0.84	−2.93	0.00	−1.40	*0.17*

[a] Independent-samples t-tests.
[b] Paired-samples t-tests.
[c] Likert scales from 0 to 10.

The statistics and goodness-of-fit indices (Table 5) led us not to reject this structure; the estimated model presents a fair fit regarding our theoretical measurement model (Chi-squared test (χ2) [161] = 284.5, RMSEA[3] = 0.06, SRMR[4] = 0.07, CFI[5] = 0.92). CRC values, AVE, and Cronbach's alpha suggest an acceptable level of consistency and convergent validity for the various latent variables ($\lambda > 0.62$; R2 > 0.38; $\alpha > 0.83$, CRC >0.70, and AVE >0.50). In addition, the values of the root mean square of AVE are higher than the correlation coefficients between constructs, which endorses the discriminant validity of said constructs (Fornell and Larcker, 1981).

Once the measurement models were calculated and validated, Table 6 presents the parameters measured at time 1 for the different models of structural equations used to test our working hypotheses. Fig. 4 illustrates the main regression model results from the SEM estimation. These results do not reject Hypotheses 1, 2, and 3, as knowledge (KNOW) has a direct, positive, and significant effect on concern (CONC) ($\beta = 0.42$, 95% CI = [0.25, 0.59]; p = 0.00); concern (CONC), for its part, has a direct, positive, and significant effect on willingness (WILL) ($\beta = 0.59$, 95% CI = [0.45, 0.73]; p = 0.00); and, finally, willingness (WILL) has a direct, positive, and significant effect on both types of behaviour (BEHA), basic and advanced (N1: $\beta = 0.50$, 95% CI = [0.38, 0.62]; p = 0.00 & N2: $\beta = 0.29$, 90% CI = [0.11, 0.47]; p = 0.00). The results seem to reject Hypothesis 4 as the direct effect of EE on both types of environmental behaviour (BEHA) is not significant (BEHA (N1: $\beta = 0.03$, 95% CI = [-0.09, 0.15]; p = 0.60 & N2: $\beta = -0.04$, 95% CI = [-0.16, 0.08]; p = 0.56). However, these results do not reject Hypothesis

5, since EE has an indirect, positive, and significant effect on both types of pro-environmental behaviour (BEHA) (N1: $\beta = 0.15$, 95% CI = [0.03, 0.27]; p = 0.038 & N2: $\beta = 0.08$, 90% CI = [0.01, 0.16]; p = 0.06). Concerning the COUNTRY control variable, it has a positive and significant effect on basic environmental behaviour, and a negative and significant effect on advanced environmental behaviour [N1: $\beta = 0.15$ & N2: $\beta = -0.31$]. Finally, goodness-of-fit structural diagnostics indicate a good relative fit of the proposed theoretical structural model with the underlying data (χ2 [131] = 189.89, RMSEA = 0.06, SRMR = 0.06, CFI = 0.93).

5. Discussion

This study confirms the sequence knowledge–concern–willingness, based on the *Theory of Reasoned Action* (TRA) and the *Theory of Planned Behaviour* (TPB) perspectives, as the right one to analyse the effect of environmental education on pro-environmental behaviour. The results obtained suggest that an increase in environmental knowledge positively affects environmental concern. This environmental concern, in turn, has a positive effect on the willingness to adopt environmentally friendly behaviours. These results are consistent with the literature that highlights the need to consider self-concepts or personal norms to understand the individuals' behaviour (Minton and Rose, 1997). Self-concepts built from knowledge could explain this sequence that reflects an individual sense of obligation towards conducts that adhere to personal values. This motivation, or sense of moral obligation, results from the increase in self-esteem experienced by individuals when they stick to their values, and the sense of guilt when they do not (Cialdini et al., 1990; Minton and Rose, 1997). In other words, the alignment of individuals' values and behaviour could justify the study's results: the more individuals know about environmental problems, their causes, and potential consequences, the greater their environmental concern and willingness to act pro-environmentally, aligning with their values

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[3] Root Mean Square Error of Approximation: Values up to 0.1 are considered an acceptable fit.
[4] Standardized Root Mean Residual: Values up to 0.1 are considered an acceptable fit.
[5] Comparative Fit Index: Values higher than 0.9 are considered an acceptable fit.

Table 4
Correlation matrix.

	KNOW1	KNOW2	KNOW3	CONC1	CONC2	CONC3	CONC4	CONC5	CONC6	CONC7	WILL1	WILL2	WILL3	WILL4	WILL5	BEHA1	BEHA2	BEHA3	BEHA4	BEHA5
KNOWLEDGE																				
KNOW1		0.71	0.58	0.15	0.28	0.18	0.31	0.05	0.32	0.14	0.34	0.23	0.26	0.14	0.16	0.15	0.19	0.13	0.34	0.26
KNOW2	0.79		0.58	0.24	0.32	0.21	0.30	0.14	0.29	0.18	0.29	0.08	0.23	0.12	0.22	0.22	0.16	0.12	0.32	0.24
KNOW3	0.59	0.64		0.12	0.16	0.03	0.18	0.01	0.20	0.07	0.29	0.17	0.17	0.08	0.16	0.20	0.15	0.21	0.28	0.25
CONCERN																				
CONC1	0.26	0.21	0.21		0.70	0.50	0.43	0.49	0.44	0.43	0.32	0.17	0.29	0.21	0.22	0.15	0.01	0.01	0.10	0.07
CONC2	0.28	0.27	0.23	0.71		0.59	0.59	0.53	0.52	0.49	0.37	0.23	0.35	0.30	0.37	0.17	−0.03	0.04	0.15	0.12
CONC3	0.20	0.20	0.21	0.54	0.59		0.41	0.39	0.35	0.66	0.32	0.26	0.26	0.21	0.23	0.18	0.02	0.11	0.13	0.09
CONC4	0.19	0.27	0.28	0.43	0.54	0.41		0.42	0.64	0.49	0.38	0.18	0.34	0.28	0.39	0.15	0.17	0.14	0.36	0.25
CONC5	0.20	0.26	0.23	0.50	0.47	0.47	0.43		0.43	0.45	0.30	0.16	0.28	0.22	0.27	0.11	0.04	0.08	0.12	0.14
CONC6	0.30	0.30	0.21	0.46	0.47	0.44	0.59	0.40		0.40	0.45	0.26	0.34	0.28	0.36	0.15	0.18	0.13	0.35	0.27
CONC7	0.32	0.32	0.21	0.44	0.49	0.59	0.51	0.46	0.52		0.33	0.28	0.35	0.28	0.33	0.24	0.06	0.11	0.20	0.13
WILLINGNESS																				
WILL1	0.36	0.40	0.32	0.36	0.30	0.31	0.37	0.23	0.36	0.38		0.62	0.58	0.43	0.46	0.33	0.16	0.27	0.46	0.30
WILL2	0.29	0.28	0.22	0.30	0.32	0.30	0.21	0.17	0.32	0.28	0.56		0.41	0.48	0.36	0.21	0.03	0.09	0.28	0.12
WILL3	0.30	0.34	0.27	0.35	0.35	0.24	0.29	0.28	0.31	0.26	0.45	0.44		0.47	0.60	0.40	−0.05	0.16	0.33	0.13
WILL4	0.20	0.28	0.21	0.25	0.21	0.20	0.28	0.21	0.34	0.23	0.40	0.57	0.54		0.59	0.23	0.00	0.13	0.27	0.15
WILL5	0.32	0.38	0.30	0.23	0.28	0.20	0.31	0.26	0.33	0.31	0.48	0.39	0.57	0.59		0.32	0.05	0.26	0.35	0.17
BEHAVIOUR																				
BEHA1	0.26	0.29	0.20	0.28	0.30	0.25	0.24	0.30	0.32	0.26	0.30	0.24	0.37	0.39	0.36		0.15	0.27	0.36	0.18
BEHA2	0.13	0.20	0.21	−0.01	−0.09	0.04	0.05	−0.08	0.12	−0.07	0.20	0.13	0.02	0.10	0.15	0.22		0.41	0.48	0.59
BEHA3	0.20	0.23	0.21	0.14	0.08	0.19	0.27	0.10	0.26	0.12	0.33	0.11	0.16	0.17	0.26	0.25	0.57		0.54	0.49
BEHA4	0.27	0.23	0.21	0.15	0.07	0.12	0.22	0.05	0.23	0.10	0.39	0.23	0.28	0.21	0.28	0.27	0.52	0.61		0.55
BEHA5	0.14	0.13	0.12	−0.02	−0.02	0.02	0.07	−0.09	0.17	−0.05	0.22	0.15	0.02	0.04	0.14	0.17	0.71	0.53	0.61	

Correlations Time 1 are below the diagonal and Time 0 are above the diagonal.

(which reflect their environmental concern). By acting in an environmentally friendly manner, and thus following the own values, individuals' self-esteem will likely increase.

This study also analyses the role of environmental education from instrumental and emancipatory perspectives. The instrumental approach suggests that the main objective of environmental education is changing environmental behaviour in a direct way, whereas the emancipatory approach focuses on creating opportunities for positive development, autonomous thinking, active dialogue, and tailored plans (Wals et al., 2008). The empirical analysis carried out confirms the emancipatory (indirect) approach as the adequate one to explain the effects of environmental education in higher education centres. Indeed, the results indicate that environmental education has an indirect positive effect, but not a direct one, on the environmental behaviour, following a sequence of variables that act as mediators. That is, those of the knowledge–concern–willingness model. These results align with recent research advances. For instance, John-Heeren et al. (2016) argue that acknowledging environmental problems is a determinant of pro-environmental behaviour, and that environmentally friendly actions are grounded in a good understanding of environmental problems, causes, and possible solutions. Onel and Mukherjee (2016) claim that the aggregate knowledge-perception-attitude is an important determining factor of pro-environmental behaviour. Duan and Sheng (2018) conclude that individuals, influenced by previous knowledge, decide to adopt environmentally friendly habits following emotional leads, such as environmental concern.

From our point of view, an instrumental approach could explain the effects of a basic environmental education (perhaps at an early age), but when individuals are ready to reach a superior cognitive level, they are able to choose pro-environmental behaviours consistent with their own values. Higher environmental education empowers them to decide what sort of pro-environmental behaviour they want to adopt.

Our results provide some guidelines as to the proposed knowledge–concern–willingness sequence. The indirect effect of environmental education largely crystallises in low-cost habits that demand a low investment of resources, such as recycling. The effect of environmental education is relatively small on high-cost habits that demand deploying greater resources in terms of money and time, such as the acquisition of 'green' products or the participation in pro-environment associations. Recent results from Rivera-Torres and Garcés-Ayerbe (2018), for instance, indicate that the adoption of individual pro-environmental behaviour begins with the adoption of low-cost habits, which over time are complemented by higher-cost behaviours. In this regard, low-cost actions, such as recycling, are more likely to be triggered by external factors than high-cost actions, such as the purchase of 'green' products or the participation in pro-environment associations. In the same vein, the results of our work suggest that, in the short term, environmental education mostly triggers low-cost environmentally friendly actions, but also, to a lesser extent, high-cost habits. Another possible explanation for these results may rely on the fact that our study is limited to the short-term effects of environmental education.

6. Implications

6.1. Theoretical implications

Our work has some theoretical implications. In the first place, it highlights the usefulness of a micro-foundational perspective for theorizing how to achieve a in the theoretical study of the ways to achieve cleaner production, thus shedding light on the antecedents of individuals' pro-environmental behaviour. In recent years, various authors have adopted this perspective to explain organisational environmental behaviour (Barney and Felin, 2013; Felin et al., 2015). Individuals act as consumers, shareholders, employees, managers, or political decision-makers, and theoretical knowledge of the mechanisms that condition their behaviours are essential for cleaner production in

Table 5

Results of the measurement models across the times.

	Time 0						Time 1					
	Knowledge	Concern	Willingness	N1_Behaviour	N2_Behaviour	R^2	Knowledge	Concern	Willingness	N1_Behaviour	N2_Behaviour	R^2
Knowledge												
KNOW1	0.84					0.71	0.85					0.72
KNOW2	0.85					0.72	0.93					0.86
KNOW3	0.70					0.49	0.68					0.46
Concern												
CONC1		0.73				0.53		0.75				0.56
CONC2		0.84				0.71		0.79				0.62
CONC3		0.70				0.49		0.73				0.53
CONC4		0.72				0.52		0.69				0.48
CONC5		0.62				0.38		0.62				0.38
CONC6		0.67				0.45		0.68				0.46
CONC7		0.67				0.45		0.70				0.49
Willingness												
WILL1			0.77			0.59			0.67			0.45
WILL2			0.63			0.40			0.66			0.44
WILL3			0.76			0.58			0.72			0.52
WILL4			0.66			0.44			0.73			0.53
WILL5			0.73			0.53			0.74			0.55
N1_Behaviour												
BEHA1				1.00						1.00		
N2_Behaviour												
BEHA2					0.65	0.42					0.80	0.64
BEHA3					0.66	0.44					0.71	0.50
BEHA4					0.80	0.64					0.74	0.55
BEHA5					0.74	0.55					0.82	0.67
α	0.83	0.87	0.83	–	0.80		0.86	0.87	0.83	–	0.85	
CR	0.80	0.71	0.71	–	0.73		0.82	0.71	0.70	–	0.78	
AVE	0.64	0.50	0.51	–	0.51		0.68	0.50	0.50	–	0.59	
Knowledge	*0.80*						*0.83*					
Concern	0.37	*0.71*					0.40	*0.71*				
Willingness	0.37	0.60	*0.71*				0.50	0.55	*0.70*			
N1_Behaviour	0.23	0.22	0.42	–			0.31	0.39	0.48	–		
N2_Behaviour	0.40	0.25	0.41	0.35	*0.72*		0.26	0.10	0.29	0.27	*0.77*	
Goodness of Fit	χ^2 [161] = 336.2 RMSEA = .07 SRMR = .07 CFI = .90						χ^2 [161] = 284.5 RMSEA = .06 SRMR = .07 CFI = .92					

Standardized path coefficients are reported and all λ are significant at p < 0.00; α: Alpha de Cronbach; CR: Composite Reliability; AVE: Average Variance Extracted.

Correlations are below the diagonal and the square root of the average variance extracted (AVE) is in italics-on the diagonal.

Table 6
Results of the structural model.

	Knowledge	Concern	Willingness	EE	Country	R2
Direct Effects						
Knowledge				0.20***	0.05	**0.04**
Concern	0.42***				0.10	**0.19**
Willingness		0.59***			−0.10	**0.35**
N1_Behaviour			0.50***	0.03	0.15**	**0.27**
N2_Behaviour			0.29***	−0.04	−0.31***	**0.18**
Indirect Effects						
N1_Behaviour				0.15**		
N2_Behaviour				0.08*		
Goodness of Fit	χ^2 [198] = 369.5 RMSEA = .06 SRMR = .07 CFI = .90					

* Significant at p < 0.10; ** Significant at p < 0.05; *** Significant at p < 0.00.
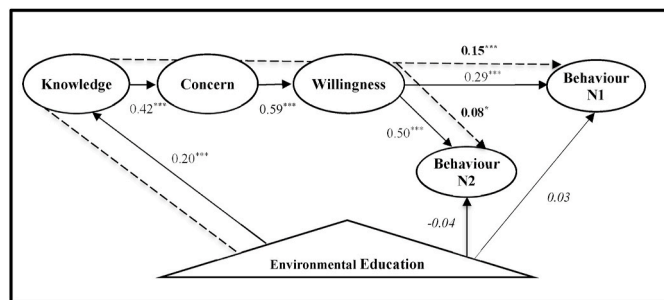
* Significant at p<.10; ** Significant at p<.05; *** Significant at p<.00

Fig. 4. Structural Regression Model Results*
Significant at p < 0.10; ** Significant at p < 0.05; *** Significant at p < 0.00.

organisations. Second, although the previous literature recognizes that knowledge, concern and willingness act as determinants of pro-environmental behaviour (Rivera-Torres and Garcés-Ayerbe, 2018), this work contributes to theoretical knowledge of the antecedents of pro-environmental behaviour by offering a sequential relationship between these determinants. Third, from an educational theoretical point of view, our results elucidate the existing debate on the study of environmental education through an instrumental or an emancipatory perspective (Wals et al., 2008; Cincera et al., 2019, 2020, 2020). However, most of them focus on the emancipatory perspective, thus ignoring the analysis of the instrumental perspective (Al-Naqbi and Alshannag, 2018; Whitley et al., 2018; Tolppanen et al., 2020). In our study, we compare the effect that environmental education has on pro-environmental behaviour from both perspectives in the same empirical model, which, to the best of our knowledge, has never been done before. This allows us to confirm the emancipatory theory and reject the instrumental perspective at one time. This way of comparing both theoretical perspectives in the same model has implications for theoretical literature as we have demonstrated that, in a university context, the instrumental approach does not affect students' pro-environmental behaviour. Conversely, the results obtained by applying the knowledge-concern-willingness model enable us to affirm that the best way to promote students' pro-environmental behaviour is through the emancipatory perspective. Also, from a psychological approach, the emancipatory perspective aligns with the TRA and TPB literature (Ajzen, 1991). In this study, we have used the knowledge-concern-willingness model to compare and contrast both educational and psychological perspectives. This model allows us to answer several questions: 1) Does environmental education have an effect on pro-environmental behaviour?; 2) Is this effect direct or indirect? and; 3) How effective is environmental education on pro-environmental behaviour? i.e., to what extent does pro-environmental behaviour increase when individuals take part on environmental management education? Also, by applying the knowledge-concern-willingness model we can observe that

environmental education not only positively influences pro-environmental behaviour, but it also affects environmental knowledge, environmental concern, and environmental willingness. Thus, environmental education changes pro-environmental behaviour by changing individuals' attitudes and values.

Our results provide insight into how to influence individuals' behaviours. In this respect, cleaner production literature links to individuals' behaviours from two perspectives: as managers and as external stakeholders. Related to the former, our analysis was based on a business degree, thus focusing on future managers. Since our results show that, by enrolling in an elective environmental subject, students' environmental actions and practices increase, it may be expected that they will implement green or environmental corporate policies in the future when working for an organisation. Then, we may also expect that, when applying all of the knowledge learnt and making corporate decisions, they will choose to improve cleaner production technologies and ways of producing and minimising risks for nature (Baas, 1995; De Oliveira-Neto et al., 2021). Our study also has implications for cleaner production literature from the stakeholder point of view (Freeman, 1984). In this way, individuals who have improved their environmental knowledge, concern, willingness, and behaviour will pressure organisations to change how they produce and manage into a more sustainable way. Individuals studying business and management are actually (and will be in the future) stakeholders such as customers or suppliers in economic market. This means that if their pro-environmental actions increase now, it will also reflect in daily purchase behaviours in the future and in the demand for more corporate responsible behaviour (Garcés-Ayerbe et al., 2019a).

6.2. Implications for practitioners, educators and policy makers

In terms of managerial implications, this research makes interesting contributions to organisations, educators, and learning practitioners. First, as future organisational actors, current business administration students should be qualified for present and future economic challenges. Environmental management has been a highly demanded skill in the last years, and new initiatives, such as the Green Deal, the Paris Agreement goals, or the United Nations Sustainable Development Goals, predict the growing importance of these competencies in tomorrow's organisations. Our main conclusions on how environmental management education affects pro-environmental behaviour are especially helpful to improve current recruitment processes valuing these abilities.

Second, universities and high education centres have a significant role in social and economic human development. As trainers and educators of future leaders, they have an opportunity to impact the near evolution of the relationship between organisations and the natural environment. Although the teaching of environmental education will vary from university to university, educators have a responsibility to foster students' scientific knowledge about environmental problems, allowing them to understand ongoing policies and search for new

alternatives. Our results show that environmental education can change the pro-environmental behaviour of students, so that educators must be aware of their ability to directly influence decision-making processes in the short, medium, and long term. Specifically, concerning the degree in business administration, where we currently framed the study, students should acquire the knowledge, understanding, and multidisciplinary skills to effectively cope with the changes, uncertainty, and ambiguity they will face as future business managers (Hailey, 1998). In this way, the number of higher education institutions integrating environmental sustainability curriculum into university curricula has significantly increased (Tasdemir and Gazo, 2020). However, recent studies show that students still feel far from the competences required to face sustainability challenges, even after their degree completion (Sánchez-Carracedo et al., 2021). Sustainability is not a core concept in management education, and these types of courses are normally elective stand-alone courses (Bagley et al., 2020; Molthan-Hill et al., 2019; Parks-Leduc et al., 2021). This can create an important self-selection bias, since those who do not recognise environmental problems tend to avoid these types of courses (Hess and Maki, 2019). Additionally, not everyone agrees with this emphasis on sustainability in business curricula because it can distract from the mission of profit maximisation (Bagley et al., 2020). In our results, we have shown that elective environmental courses affect pro-environmental behaviour. It may be necessary to improve all student environmental education through mandatory environmental courses if these are important goals for a business administration degree. In short, educators should be aware that they may be affecting the decisions of future managers, and they should ask themselves what kind of managerial decisions we want to see in the future. Alternatively, perhaps we should go even further: what kind of future do we want for the world? It is important to highlight that from an ethical or moral point of view, it seems risky to see environmental education as a way of changing private or public behaviour, even indirectly. In the wrong hands, this could be used to manipulate or indoctrinate. Having the power (or the aim) to change the behaviour of others through environmental education may lead to an even worse problem than the environmental crisis.

The results of the study, on the other hand, also have implications for policymakers. The great number of Sustainable Development Goals related to the conservation of the natural environment shows the importance that public institutions and policymakers give to nature: Goal 7: Affordable and clean energy; Goal 11: Sustainable cities and communities; Goal 12: Responsible consumption and production; Goal 13: Climate action; Goal 14: Life Below Water and Goal 15: Life on land. All the mentioned Sustainable Development Goals have something in common on how to reach them: Try to change the way society and organisations act. Recently some voluntary initiatives like PRME have increased their importance related to sustainability education. This study's results are aligned with the way this platform works focused on changing how to educate students and train and give support to those institutions who are members. Following this statement, the current literature affirms that the individual behaviour of managers is a central driver in the organisational decision-making process towards more advanced environmental positions. New policy instruments could consider our results in order to develop more advanced and efficient strategies. They could improve businesses environmental performance through managers and their levels of knowledge, concern, and willingness, which could be impacted through environmental management training and learning.

7. Conclusions

The overexploitation of limited resources strengthened the destruction of the natural environment, which is determined, directly or indirectly, by human behaviour. In our study, we have analysed how individual pro-environmental actions and practices are increased by environmental education. The main conclusion points out that pro-environmental behaviour, including advanced pro-environmental behaviour, can be motivated when environmental education is delivered in higher education centres from an emancipatory perspective. The empirical evidence obtained indicates that environmental education has a positive effect on the knowledge of both environmental problems and the main ways of solution. This knowledge generates individual concern, awakens the willingness to participate and, finally, participation in pro-environmental actions.

We have discussed in previous sections the impact that our results could have on academic theory and on our daily world. However, we also want to record some limitations of the study. The first of these limitations is that pro-environmental behaviour is measured through self-reported questionnaires. Nonetheless, given the way we framed the study, we think that this is the most efficient way to collect the data (Chao, 2012). On the other hand, it has been argued that these results may be a consequence of the cross-sectional nature of the enquiry. This study could be contrasted and complemented with longitudinal analyses.

Once these limitations are established, the final reflection of this work is that higher environmental education is not a tool to change individuals' actions in a purely instrumental, way but instead is a way to promote personal growth and critical thinking. The conclusions obtained show the relevance of educating and providing environmental knowledge to individual organisational actors who must guarantee future cleaner production. Current students are the future, and our future lies in their hands. Let's think about the future we want, and let's start creating the foundations for it.

CRediT authorship contribution statement

Inés Suarez-Perales: Conceptualization, Project administration, Formal analysis, Writing – original draft, Writing – review & editing, Investigation. **Jesus Valero-Gil:** Conceptualization, Project administration, Formal analysis, Writing – original draft, Writing – review & editing, Investigation, Conceptualization, Methodology, Investigation, Data curation, Writing – original draft. **Dante I. Leyva-de la Hiz:** Investigation, Data curation, Resources. **Pilar Rivera-Torres:** Visualization, Methodology, Formal analysis, Data curation. **Conchita Garcés-Ayerbe:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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APPENDICES

Appendix A. Printout of the questionnaire used to collect empirical data

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CODE: _____

GENDER: ☐ Female ☐ Male.   **AGE:** ☐ 18-25 years ☐ 26-30 years ☐ More than 30 years
SUBJECT: ☐ Environmental Management ☐ Other

Please read carefully the questions and answer according to your knowledge, concerns and behaviors. This is NOT an exam, there are not any correct and incorrect answers and the data will be treated under strict security measures to guarantee the total anonymity.

KNOWLEDGE

Using a 0-10 scale (where 0 implies "I do not know them nothing" and 10 "I know them totally") to express your opinion, What is your actual level of knowledge about…

…major environmental problems?	0	1	2	3	4	5	6	7	8	9	10	NA
…the main causes of environmental problems?	0	1	2	3	4	5	6	7	8	9	10	NA
…the main solutions or mitigation measures for environmental problems?	0	1	2	3	4	5	6	7	8	9	10	NA

CONCERN

Using a 0-10 scale (where 0 implies "I am not concern" and 10 "I am very concern") to express your opinion, What is your actual level of concern about these environmental matters?

Air pollution	0	1	2	3	4	5	6	7	8	9	10	NA
The pollution of the seas, rives, etc…	0	1	2	3	4	5	6	7	8	9	10	NA
Climate change	0	1	2	3	4	5	6	7	8	9	10	NA
Accumulation of residues	0	1	2	3	4	5	6	7	8	9	10	NA
Water scarcity	0	1	2	3	4	5	6	7	8	9	10	NA
The use of pesticides and chemical products	0	1	2	3	4	5	6	7	8	9	10	NA
Increase of temperatures worldwide	0	1	2	3	4	5	6	7	8	9	10	NA

WILLINGNESS

Using a 0-10 scale (where 0 implies "I am totally disagree" and 10 "I am totally agree") to express your opinion, express your level of agree/disagree with the following statements:

I would be willing to pay extra for more environmentally friendly products	0	1	2	3	4	5	6	7	8	9	10	NA
I would be willing to pay extra taxes to protect the environment	0	1	2	3	4	5	6	7	8	9	10	NA
I would be willing to change my daily habits to protect the environment	0	1	2	3	4	5	6	7	8	9	10	NA
I would be willing to obey norms that restrict the use of private vehicles in urban areas	0	1	2	3	4	5	6	7	8	9	10	NA
I would be willing to accept restrictions in individual residue generation	0	1	2	3	4	5	6	7	8	9	10	NA

BEHAVIOUR

Using a 0-10 scale (where 0 implies "Never" and 10 "Always") to express your opinion, How often do you carry out the following actions?

Use separate containers for different types of recyclable product e.g. glass, containers, paper, cardboard…	0	1	2	3	4	5	6	7	8	9	10	NA
Join pro-environment actions (clean parks, beaches, plant trees)	0	1	2	3	4	5	6	7	8	9	10	NA
Buying products with minimal or recyclable packaging	0	1	2	3	4	5	6	7	8	9	10	NA
Raise awareness among friends and relatives, and encourage them also to protect the environment	0	1	2	3	4	5	6	7	8	9	10	NA
Collaborate with associations the main aim of which is to protect the environment	0	1	2	3	4	5	6	7	8	9	10	NA

Appendix B. Environmental Management module syllabus detail

Topic 1: Economic Consideration of environmental degradation
1.1.- Relationship between economy and environment
1.2.- Environmental problems arising in economic activity
1.3.- Environmental economics concept
1.4.- The social costs and private costs: the concept of externality
1.5.- The problem of allocation of natural resources
Topic 2: Methods for appraising environmental quality
2.1.- The value of natural resources
2.2.- Indirect methods for environmental valuation
2.3.- Direct methods for environmental valuation
Topic 3: Economic instruments for environmental protection
3.1.- Coasian and Pigouvian Solutions
3.2.- Pigouvian Solutions: taxes and subsidies
3.3.- Pigouvian Solutions: prohibitions
3.4.- Coasian Solutions: markets
Topic 4: Environmental policy in the European Union
4.1.- Introduction: From Command-and-Control to Market-Based instruments
4.2.- Integrated Pollution Prevention and Control Law (IPPC)
4.3.- Environmental taxes
4.4.- The European Pollutant Release Transfer Register (PRTR)
4.5.- European emissions trading system
4.6.- The Integrated Management Systems: The Case of Packaging Waste Management
Topic 5: Environmental management systems in the company
5.1.- Definition of environmental management system
5.2.- Implementation of an environmental management system
5.3.- Certification of environmental management system
5.4.- Tools for environmental management
Topic 6: Determinants and consequences of environmental proactivity in the company
6.1.- Strategic Environmental Behaviour
6.2.- Determinants of environmental proactivity 6.3.- Economic consequences of environmental proactivity

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