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EFFECTS OF EDUCATION FOR SUSTAINABLE DEVELOPMENT ON PERSONAL NORMS REGARDING THE SCARCITY OF DRINKING WATER

Efeitos da educação para o desenvolvimento sustentável nas normas pessoais quanto à escassez de água

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ABSTRACT

Purpose: This study aims to investigate effects of education for sustainable development (ESD) on university students' personal norms regarding the scarcity of drinking water in light of the value-belief-norm theory (VBN).
Design/methodology/approach: The empirical research was developed at the Federal University of Bahia. The final sample was composed of 1,096 university students. The questionnaire was validated qualitatively and quantitatively. For hypothesis testing, Structural Equation Modeling was employed.
Findings: Results indicated that the level of education for sustainable development positively impacted only biospheric values. The findings demonstrate that the impact of education for sustainable development depends on its quality, quantity, distribution, and diffusion in curricula.
Research implications: This research is based on VBN theory and contributes to the body of literature of EDS. It suggests that individuals' values are in fact guiding principles of their beliefs.
Practical implications: Biospheric values were found to have a positive effect on ecological beliefs. Nevertheless, it was found that in order to feel a moral obligation to act, students need to believe that, in fact, drinking water scarcity is a serious problem for society.
Social implications: This research adds insights to the matter of educating the younger generation of students in view of the recent (2021-2022) water crisis in Brazil.
Originality/value: The analysis of effects of "level of education for sustainable development" on individuals' values, impacting the VBN chain to explain student coping with drinking water scarcity is an original contribution of this study.

Keywords: Education for sustainable development; Drinking water scarcity; Value-belief-norm theory; Sustainability.

RESUMO

Objetivo: Investigar os efeitos da educação para o desenvolvimento sustentável (EDS) nas normas pessoais dos estudantes universitários quanto à escassez de água potável à luz da teoria da crença-norma de valor (VBN).
Design/metodologia/abordagem: A pesquisa empírica foi desenvolvida na Universidade Federal da Bahia. A amostra final foi composta por 1.096 universitários. O questionário foi validado qualitativamente e quantitativamente. Para o teste de hipóteses, foi utilizada a Modelagem de equações estruturais.
Resultados: O nível de EDS impactou positivamente apenas os valores biosféricos. Os achados demonstram que o impacto da EDS depende de sua qualidade, quantidade, distribuição e difusão nos currículos.
Implicações para pesquisa: Esta pesquisa está baseada na Teoria VBN e contribui para a literatura sobre EDS. Sugere ainda que valores dos indivíduos são, de fato, princípios norteadores de suas crenças.
Implicações práticas: Valores biosféricos tiveram um efeito positivo sobre as crenças ecológicas. No entanto, verificou-se que, para sentir a obrigação moral de agir, os alunos precisam acreditar que, de fato, a escassez de água potável é um problema sério para a sociedade.
Implicações sociais: Esta pesquisa agrega *insights* à questão de educar a geração mais jovem de estudantes, tendo em vista a recente crise hídrica (2021-2022) no Brasil.
Originalidade/valor: A análise dos efeitos do "nível de EDS" nos valores individuais impactando a cadeia VBN para explicar o enfrentamento do aluno à escassez de água potável é uma contribuição original deste estudo.

Palavras-chave: Educação para o desenvolvimento sustentável; Escassez de água potável; Teoria do valor--crença-norma; Sustentabilidade.

1 INTRODUCTION

Water is one of the most critical resources for the promotion of sustainable development, both from a socio-environmental and economic perspective. For this reason, historically there have been conflicts regarding the uses and conservation of the planet's water matrix (Castro, 2007). For instance, in the neoliberal perspective, it is argued that access to water should be regulated according to market mechanisms, while other socio-political-economic ideologies, such as those based on social-democratic perspectives, argue that access to drinking water, due to its essentiality for planetary survival, should be regulated as a good for common use by the people, and therefore its appropriation is inadmissible under the aegis of the market (Woodhouse; Muller, 2017).

In addition to natural hydrological causes (eg: the effects of climate change, periods of drought and soil cover in runoff), the problem of drinking water scarcity is also a social construction, which has historically been a consequence of the political-economic context, especially with regard to planning and management approaches (Brennan; Yeuk-Sze, 2002; Saurí, 2013; Woodhouse; Muller, 2017).

Given this complex scenario, the value-belief-norm theory (VBN) systematized by Stern et al. (1999) proposes to explain and predict attitudes and behaviors in defense of environmentalism. In general terms, the VBN theory presents as a fundamental pillar the value orientations of individuals, which play the role of guiding principles of their beliefs. Indeed, beliefs would be important predictors of the psychological state regarding the sense of responsibility for environmental preservation. Therefore, in order to have sustainable attitudes and behaviors, individuals would need to believe in the consequences of human action. At the same time, they would need to feel the moral obligation to undertake efforts to prevent environmental damage from occurring (Stern, Dietz, Abel, Guagnano & Kalof,. 1999; Stern, 2000; Steg; Dreijerink; Abrahamse, 2005; Steg, Bolderdijk, Keizer & Perlaviciute, 2014; Whitley, Takahashi, Zwickle, Besley & Lertpratchya, 2016).

From this perspective, Saurí (2013) further adds that the most promising approaches that seek to understand water conservation attitudes try to explore the influence of values and beliefs on individuals' decision-making processes. In addition, emphasis has historically been placed on educa-

tion, which is considered an effective strategy to induce behavioral changes along the path of water conservation (Saurí, 2013; Jacomossi; Morano; Barichello, 2014).

Indeed, for Muijen (2004) the terms "values education" and "sustainable development" are intertwined. As evidence of this, the United Nations Educational, Scientific and Cultural Organization (UNESCO) consider that education is crucial to the promotion of sustainable development, since in addition to contributing to the development of knowledge and skills, it has the potential to have an impact on the values and attitudes of individuals (UNESCO, 2017).

Nevertheless, when it comes to the scope of universities, it is expected that these can foster more complex learning environments, as argued by Astin (1993), Pascarella & Terenzini (2005), Sheldon (2005) and Whitley et al. (2016). University students differ from other populations, for being immersed in an environment that has the potential to contribute to the exercise of critical reflection of value orientations and internalized beliefs, at different stages of socialization. Based on this assumption, this research aims to analyze the effects of education for sustainable development on the personal norms of university students regarding the scarcity of drinking water, in light of the value-belief-norm theory.

The analysis of effects of "level of education for sustainable development" on individual's values, impacting the VBN chain, aiming to explain the students' coping with the scarcity of drinking water, is an original contribution of this study. The evidence obtained here has the potential to contribute to suggest improvements of public and pedagogical policies that seek to incorporate, in the students' academic education, a conception that enhances the reflexive and critical actions of individuals towards sustainable development. It is noteworthy that these potential contributions become even more relevant for the Brazilian scenario, since the country is facing the worst shortage of water in 91 years (ANEEL, 2021).

2 THEORETICAL FRAMEWORK AND HYPOTHESES

Understanding the factors that influence individuals' attitudes and behaviors towards sustainable development is a difficult task due to the complexity of the variables involved. Values, beliefs, personal and social norms, emotions, level of knowledge, partisan identity, religion, income, gender, education, institutional and sociocultural context are some of the factors that can significantly impact individual's behavior towards sustainability issues (Gorni; Gomes; Dreher, 2012; Wiernik; Ones; Dilchert, 2013; Saurí, 2013).

Indeed, Udall et al. (2021), Topal, Hunt & Rogers (2021) highlight that research in this field has been conducted predominantly by theories grounded under the aegis of social psychology; among them are: the theory of planned behavior, the theory of norm activation, and the theory of value-belief-norm (VBN). Given this scenario, investigations have been conducted with the purpose of testing which model has greater predictive power in the context of sustainability.

However, as exposed by Bertoldo (2013) the choice of which model to use depends largely on how these behaviors are understood. In view of this, for this research, we chose to use the value-belief-norm theory because it considers that personal norms are an internalized set of values and beliefs and not merely repetitions of ways of behaviors, thus carrying potential elements for promoting changes in society.

From this perspective, there is evidence, from several empirical contexts, suggesting that the VBN Theory is a suitable theoretical framework to explain attitudes and behaviors towards environmental preservation (Steg; Dreijerink; Abrahamse, 2005; Steg et Al. 2014; Whitley et al. 2016; Hiratsuka; Perlaviciute; Steg, 2018; Liu; Zou; Wu, 2018; Yildirim; Semiz ,2019; Su et al. 2021; Smilingytė; Šorytė, 2021).

The value-belief-norm theory, systematized by Stern et al. (1999) presented relevant contributions in the theoretical field of social psychology when discussing the interfaces between environmentalism and social movements. This approach contributed assertively to explain and predict attitudes and behaviors in favor of environmental issues, through the inter-relation, in cascade, among values, beliefs and personal norms, based on the assumption that the value orientations of individuals are conceived as underlying structures that influence individuals' decision-making processes.

Under this perspective, values would be considered as concepts about end states or desirable behaviors, which transcend specific states, and guide the selection or evaluation of behavior and events (Schwartz; Bilsky, 1987). The initial approach to VBN theory proposed by Stern et al. (1999) considered only three types of value orientations applicable to the case of environmentalism. These were: self-interest (egoistic), altruistic toward other humans (altruistic), and altruistic toward other species and the biosphere (biospheric).

Based on this assumption, individuals with an egoistic value orientation are those who would prioritize their own well-being. They have the following predominant characteristics: social power, wealth, authority, ambition, and influence over people and events, with a focus always on maximizing individual results. Whereas altruistic values consider the well-being of others as fundamental. Therefore, they advocate equal opportunities for all, a world free of wars and conflicts, the promotion of social justice, and working for the welfare of people. Finally, biospheric values are based on the protection and preservation of natural resources, the need for harmonious coexistence with other species, as well as feeling as an integral part of nature (Stern, 2000; Steg; Dreijerink; Abrahamse, 2005; Steg et al., 2014).

A belief is considered to involve a perceived awareness of the consequences (AC), i.e., a diagnosis, which will imply a prognosis, through attribution of responsibility (AR). Finally, a personal norm in favor of environmental issues would be the variable closest to behavior in favor of environmentalism. Therefore, as Stern (2000) summarizes, the VBN theory links value theory, norm activation theory, and the New Environmental Paradigm through a causal chain of variables: personal values, beliefs (New Ecological Paradigm-NEP, Awareness of Consequences - AC, Ascription of Responsibility - AR), and personal norms in favor of environmental issues, as shown in Figure 1.

Figure 1 - Systematic representation of the VBN Model.

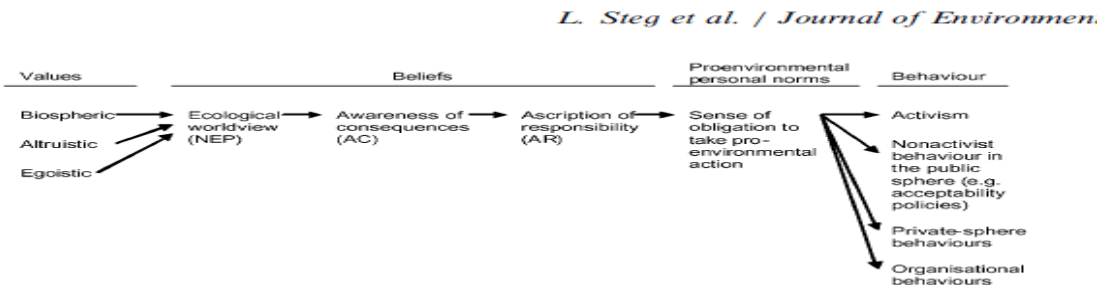


Fig. 1. A schematic representation of the VBN theory of environmentalism (adapted from Stern, 2000).

.Source: Stern (2000)

In view of the above, it can be noticed that the VBN theory presents, as a fundamental pillar, the values of individuals, which play the role of guiding principles of their beliefs. Indeed, beliefs would be important predictors of the psychological state of individuals with regard to their sense of responsibility. Therefore, to have sustainable attitudes and behaviors, individuals would need to believe in the consequences of human action, and at the same time feel a moral obligation to prevent harm from occurring (Stern, et al. 1999; Stern, 2000; Steg; Dreijerink; Abrahamse, 2005; Steg et al., 2014; Whitley et al., 2016).

It is worth noting that, based on the evidence found by Steg et al (2014) in the Netherlands and Hiratsuka, Perlaviciute & Steg (2018) in Japan, in addition to egoistic, altruistic and biospheric value orientation, the hedonic values dimension was added in this investigation. The authors found that hedonic values tend to make people undertake efforts to have pleasure, satisfy desires, enjoy life (enjoying food, sex, leisure, among others), and self-indulgence. It was found that these values were not only theoretically meaningful, but also recognized by individuals as different from egoistic values.

It should be noted that the role of education in the formation of values has been studied and confirmed by several authors, such as Halstead & Taylor (1996), Lewis, Mansfield & Baudains (2008), Degasperi & Bonotto (2017) and Diwan & Vartanova (2018). From this perspective, in addition to being able to contribute to the development of knowledge and skills, education for sustainable development has an impact on individuals' values. These are elements learned in socialization processes and incorporated into the self-concept, so they tend to be more stable throughout life. They have the potential to impact, in cascade, individuals' beliefs and, consequently, contribute to the awakening of learners' moral obligation to prevent socio-environmental damage from occurring. Muijen (2004) defends the interdependence between the terms "values education" and "sustainable development". Under the conceptual apparatus of VBN theory, education for sustainable development is expected to have a positive impact on altruistic and biospheric values and a negative impact on hedonic and egoistic values. Based on this assumption, the first hypothesis was transformed into two sub-hypotheses: H1a and H1b:

H1a: There is positive impact of education level for sustainable development on altruistic and biospheric values.

H1b: There is negative impact of education level for sustainable development on egoistic and hedonic values.

Broadly speaking, in light of the value-belief-norm theory, individuals with altruistic and biospheric value orientation are expected to be influenced by efforts to promote the welfare of people and the environment, respectively, and are expected to have the potential capacity to forgo and/or sacrifice self-interest and the propensity to develop both beliefs and behaviors toward sustainability. Assuming that human activity and the environment are inextricably interconnected, ecological beliefs are expected to be influenced positively by altruistic and biospheric values and negatively by egoistic values (Steg; Dreijerink; Abrahamse, 2005; Steg et al., 2014; Yildirim; Semiz, 2019).

The study by Steg, Dreijerink & Abrahamse (2005) is considered one of the main references for empirical testing of the VBN theory. Through regression analysis, the causal order of variables in the theory was confirmed. Results also indicated that biospheric values positively impacted both personal beliefs and norms regarding reducing household energy consumption. Similar findings were found by Steg et al. (2014) based on a sample of 106 students at a Dutch university.

Under the lens of value-belief-norm theory, Whitley et al. (2016) investigated which social psychological factors influence sustainability behaviors in the United States. Structural equation modeling results suggested that individuals with egoistic value orientations are less likely to develop pro-sustainability behaviors, thus individual values are important in decision-making processes, therefore different values were found to have different impacts on behavior.

Building on this assumption, Hiratsuka, Perlaviciute & Steg (2018) tested the VBN theory in Japan and identified that the more people hold biospheric values, the more they believe that car use has negative environmental impacts and feel responsible for the problems that are caused, and therefore feel personally obligated to reduce car use. An opposite effect was found by egoistic and hedonic value orientations. The effects of egoistic values were stronger compared to hedonic values.

In a broader scope, similar findings were found by Wu & Zhu (2021). Through structural equations, the authors identified that biospheric values positively impacted ecological beliefs. The findings further indicated that ecological beliefs positively impacted personal norms and these positively affected conscious consumption. In the specific context of water saving, Aprile & Fiorillo (2017) identified a positive relationship between altruistic environmental concerns and water conservation behavior. In addition, the authors found that environmental knowledge was a driver of water conservation behavior.

With specific regard to the context of water conservation, Corral-Verdugo, Bechtel & Fraijo-Sing (2003) categorized beliefs about drinking water into two types: utilitarian and ecological. The researchers found (via structural equations) that ecological beliefs about water contributed positively to water-saving behavior, whereas utilitarian beliefs had the opposite effect.

Evidence of the relevance of the beliefs dimension to explain sustainability behavior was demonstrated in research conducted by Liu, Zou & Wu (2018) in China. The research analyzed the applicability of the VBN theory and, through structural equations, the authors found that biospheric values positively influenced environmental beliefs, while egoistic values had a negative impact. Finally, the authors identified positive effects of environmental beliefs on personal norms.

It is important to highlight that there is no consensus in the literature regarding the direct effects of personal norms on the behavior of individuals. In this sense, with the purpose of identifying factors that influenced environmental behavior from the perspective of reducing solid waste generation, Smilingytė & Šorytė (2021) obtained results indicating the impact of biospheric values as the best positive predictor of ecological beliefs. Furthermore, the findings demonstrated that ecological beliefs positively affect students' personal norms and these in turn positively impact the behavior of the respondents.

In Turkey, Yildirim & Semiz (2019) investigated factors impacting water consumption. The research, conducted in light of VBN theory, found that personal norms were a strong indicator to explain the behavior of respondents. Based on this assumption, the authors highlight the importance of enhancing biospheric and altruistic values, environmental beliefs, and personal norms for the development of behaviors towards sustainable development. Given this context, the second hypothesis of this research investigates the effects of values on ecological beliefs regarding water consumption. For operational purposes, the second hypothesis was transformed into two sub-hypotheses: H2a and H2b.

H2a: Altruistic and biospheric values have a positive effect on ecological beliefs about drinking water.

H2b: Egoistic and hedonic values have a positive effect on utilitarian beliefs about drinking water.

Also, in the context of water conservation, Raeisi, Bijani & Chizari (2018) through structural equation modeling based on a sample of 384 wheat farmers in Iran, also identified the positive effects of environmental beliefs on the sustainable use of water resources. Moreover, the authors also identified a positive and significant relationship between environmental knowledge and water conservation behavior.

Moghadam, Raheli, Zarifian & Yazdanpanah (2020), when seeking to capture the effects of beliefs related to water conservation as a factor for promoting health in Iran, found that such beliefs

were substantiated as an important predictor of water conservation behavior. Regarding the conscious consumption perspective, Kang et al. (2017) investigated the impact of utilitarian and ecological beliefs on the Hispanics' water consumption attitudes, and found evidence that utilitarian beliefs about water negatively affected sustainable water consumption attitude, whereas, as expected in the literature, ecological beliefs exert positive effects on sustainable water consumption attitude.

In a more comprehensive study, Su et al. (2021) investigated factors influencing water-saving behaviors in China and found that egoistic values negatively impacted this predisposition, while biospheric values positively impacted personal norms on this matter. The authors also found that knowledge about watersaving positively impacted biospheric values, as well as personal habits and water-saving behaviors.

It is important to highlight that this research investigated the relationships proposed by the triad of the VBN theory. From this perspective, we analyzed the effect of beliefs about water scarcity on students' personal norms in relation to coping with this problem, that is, we sought to identify whether individuals felt a moral obligation to not only avoid wasting drinking water, but also to undertake efforts to save it as much as possible.

Building on this assumption, Schwartz (1977) points out that violation of personal norms may produce feelings of guilt, self-denial, or loss of self-esteem whereas obedience would generate feelings of pride and increased self-esteem. Therefore, for Zhang, Zhao, Ni & Cai (2021) individual norm is the variable closest to environmental behavior in VBN theory. Therefore, according to this theory, sustainable development behaviors are influenced by individuals' psychological state with regard to their sense of responsibility. Therefore, personal norms are expected to contribute to encouraging sustainable development behaviors.

From this perspective, in the context of this research, personal norms of water conservation are expected to be influenced positively by ecological beliefs and negatively by utilitarian beliefs. Based on this assumption, the third and final hypothesis of this research investigates the effects of beliefs on the students' personal norms. For operational purposes, the third hypothesis was transformed into two sub-hypotheses: H3a and H3b.

H3a: There is positive impact of ecological beliefs on personal norms of coping with drinking water scarcity.

H3b: There is negative impact of utilitarian beliefs on personal norms of coping with drinking water scarcity.

3 METHOD

To achieve the objective of the study, empirical research was developed at the Federal University of Bahia, one of the best universities in the Brazilian Northeast, according to the 2020 ranking of the Center for World University Rankings (CWUR). As an instrument of data collection, a questionnaire was developed. Preliminarily, translation, pre-testing and semantic validation of the instrument and its scales (which were originally in English) were performed. It is noteworthy that in the process of development, and qualitative validation, the scales were translated, retranslated and submitted to the analysis of judges (three PhD professors), in order to identify inconsistencies and verify the understanding of the questions and the meaning of the dimensions.

Thus, based on the specialists' recommendations, the instrument was improved. Next, a pre-test of the questionnaire performed; it was administered to 14 undergraduate students. Minor additional adjustments to the questions were performed. In the first block, the scale developed by Steg et al. (2014) was used to identify the students' values. From this perspective, four distinct values were considered: Hedonic, Egoistic, Altruistic, and Biospheric, as shown in Table 1.

Table 1 – Block 1 of questionnaire: values

	Questionnaire Question	
	Dimension	Analyze the following values, how important is each value to you? Your answers can range from -1 to 7. -1 (minus one) means that the value is opposite you. The higher the number the more important the value, so 7 (seven) means that the value is of utmost importance to you.
Block I	Hedonic Values	PLEASURE: joy, satisfaction of desires
		ENJOY LIFE: enjoying food, sex, leisure, etc.
		SELF-INDULGENT: doing pleasant things
	Egoistic Values	SOCIAL POWER: having control over others, dominance
		WEALTH: material goods, Money
		AUTHORITY: the right to lead or command
		INFLUENCER: to have impact on people
		AMBITIOUS: to work hard, aspire to rise in your career
	Altruistic Values	EQUALITY: equal opportunities for all
		A WORLD IN PEACE: free of wars and conflicts
		SOCIAL JUSTICE: fighting injustices, caring for the weak
		HELPFUL: working for the well-being of others
	Biospheric Values	RESPECT THE EARTH: harmony with other species
		UNITY WITH NATURE: feeling integrated with nature
		PROTECT THE ENVIRONMENT: preserving nature
		PREVENT POLLUTION: protection of natural resources

Source: Steg et al, 2014.

In the second block, we used the scale developed by Corral-Verdugo, Bechtel & Fraijo-Sing (2003) with the purpose of identifying the beliefs of the respondents about the problem of water scarcity. Based on this assumption, beliefs were presented in two categories: utilitarian and ecological, as shown in Table 2.

	Questionnaire Question	
	Dimension	On a scale of 1 (totally disagree) to 5 (totally agree), indicate how much you agree with the following beliefs.
Block II	Utilitarian Beliefs	There is no shortage of drinking water
		Humans have the right to use all the water they desire
		Science will solve water supply problems before they become serious
	Ecological Beliefs	I consider water to be a scarce resource that must be carefully preserved
		Drinking water will run out very soon if we don't change the way we consume it
		The scarcity of drinking water is a serious problem for society

Source: Adapted from Corral-Verdugo, Bechtel and Fraijo-Sing (2003).

In the third block, we used the scale of Steg, Dreijerink & Abrahamse (2005), originally developed to measure personal norms about energy saving, but it was adapted, in order to identify the personal norms of individuals with regard to facing the scarcity of drinking water, as shown in Table 3. We used a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) as it was in the original scale.

Table 3 - Block 3 of the questionnaire: personal norms

Block III of the Questionnaire	Questionnaire Question	
	Dimension	On a scale of 1 (strongly disagree) to 5 (strongly agree), please indicate how much you agree with the following personal norms.
Block III	Personal Norms	I feel personally obligated to save as much water as possible.
		I feel guilty when I waste water.
		People like me should do everything they can to reduce water use.
		I would be a better person if I saved water.
		I feel morally obligated to save water, regardless of what others do.

Source: Adapted from Steg, Dreijerink & Abrahamse (2005)

In the fourth block, we adapted scales developed based on studies the showed that both the quantity and quality of knowledge that is taught are important for student learning (Chin et al., 2012; Castelló-Climent & Hidalgo-Cabrillana, 2012). The students' perception of the dispersion of content throughout the course was also measured, since a punctual and isolated content tends to be less effective than a more diffused content. Based on this, we aimed to map the level of education for sustainable development during the undergraduate course of the investigated students. It is also noteworthy that to achieve the proposed objective a ten-point Likert-type scale was used, in which the level of agreement with the questions had a range of 0 to 10, as shown in Table 4.

Table 4 - Block 4 of the questionnaire: level of education

	Questionnaire question	
	Dimension	
Block IV of the questionnaire	Level of Education for Sustainable Development	On a scale of 0 (No content), 1 (Very unfamiliar) to 10 (Very familiar), please rate the presence of sustainable development-related content in the courses you have taken throughout your course.
		On a scale of 0 (No contents), 1 (Very Bad) to 10 (Very Good), please rate the quality of the contents related to sustainable development in the courses you have taken along your course.
		On a scale of 0 (No contents), 1 (Very isolated) to 10 (Very widespread), please rate the diffusion and distribution of contents related to sustainable development in the courses you have taken along the course.
		On a scale of 0 (No content), 1 (Very little) to 10 (Very much), please rate the amount of sustainable development related content in the courses you have taken throughout your course.

Source: Adapted from Chin et al., 2012; Castelló-Climent & Hidalgo-Cabrillana, 2012.

In the meantime, it is reasonable to assume that students with very short time in the course are not able to effectively evaluate the quality, quantity, distribution and diffusion of education in the curricula. This could create a confounding effect. Therefore, the final sample included only students from the 5th semester on. It is worth mentioning that, due to the new coronavirus (COVID-19) pandemic scenario, the research invitation was sent to the students by the UFBA Pro-Rector of Undergraduate Education, via email. The data were collected between the months of October and November 2020, through the SurveyMonkey platform, the average response time was 9 minutes and the completion rate was 89%. Before being submitted for analysis, the constructed database was manipulated with the purpose of reducing possible noise due to cases in which the individual marked the same answer option for all questions.

Data from respondents that fell into these circumstances were eliminated from the sample. The online questionnaire was designed in such a way that no blank answers could be submitted, as all questions required a mandatory response. Under this perspective, the final sample submitted for analysis was composed of 1,096 respondents, which included 682 students who self-declared as female (62%) and 414 as male (38%). As for the age range, it was found that most students (74%) were between 18 and 30 years old. It was also identified that most students were single (83%), had no children (86%), had no employment relationship (56%), lived in Salvador (85%), rated as "great" their access to drinking water (66%), and had a family income of up to 3 minimum (Brazilian) wages (56%).

Structural equation modeling was used to analyze and interpret the results. At first, in order to carry out the quantitative validation of the questionnaire, only Confirmatory Factor Analysis (CFA) was used. It is worth noting that Exploratory Factor Analysis (EFA) was not used since the structures of the categories that were investigated already have a theoretical basis (Yang, 2005). The data were analyzed with the help of SPSS AMOS software. It is noteworthy that path analysis was used to test the hypotheses. Through path analysis the validity of theoretical models is tested, in which multiple and hypothetical linear relationships between variables are defined (Hox; Bechger, 1998). This technique was used in order to assess the influence of education for sustainable development on students' coping with drinking water scarcity in light of the VBN theory.

4 ANALYSIS OF RESULTS

4.1 QUANTITATIVE VALIDATION OF THE QUESTIONNAIRE: CONFIRMATORY FACTOR ANALYSIS (CFA)

Through the confirmatory factor analysis, it was checked if the fit of the factorial structure of the theoretical dimensions used in this research is satisfactory. As shown in Table 5, the number of items per factor ranged from three to five. This proportion is in line with what several researchers on the subject suggest (e.g., Maccallum, et al., 1999; Raubenheimer, 2004). As emphasized by Hulin, Netemeyer and Cudeck (2001), Cronbach's alpha values measure internal consistency and depend on the number of items in the scale. In order to be considered acceptable they are suggested to be above 0.6 (Yusoff et al., 2011). Based on this assumption, it was found that of the eight factor structures that were tested, only utilitarian beliefs and hedonic values had Cronbach's alphas lower than 0.6, as shown in Table 5. Given this scenario, due to the low internal consistency of these factors, it was decided to exclude them from subsequent analyses.

Table 5- Cronbach's Alpha (n=1.096)

Factors	Cronbach's Alpha	# of Items	Factors	Cronbach's Alpha	# of Items
Level of Education for Sustainable Development	0.954	4	Hedonic Values	0.579	3
Altruistic Values	0.675	4	Ecological Beliefs	0.654	3
Biospheric Values	0.851	4	Utilitarian Beliefs	0.482	3
Egoistic Values	0.71	5	Personal Norms	0.828	5

Source: Survey Data, 2021.

With regard to factor loadings measured through normalized coefficients, as recommended by Hair et al. (2014, p.115), loadings of 0.7 or greater are ideal, but items with factor loadings greater than 0.5 are acceptable. It was found that the factor “altruistic values” had two items with factor loadings below 0.5. By eliminating those items, only two items would remain in the scale altruistic values, which have low correlation among themselves (0.403). Gosling, Rentfrow and Swann Jr. (2003) mention that a scale with only two items may present identification problems in the confirmatory factor analysis if the remaining items of the scale are not highly correlated. Therefore, the “altruistic values” factor was removed from the model. A summary of the results of the model’s CFA is presented in Table 6.

Table 6- Confirmatory fator analysis (n=1.096)

Factors/Items	Factor Loading	p-value	Factors/Items	Factor Loading	p-value	Factors/Items	Factor Loading	p-value
level of education for sustainable development			Biospheric Values			Ecological Beliefs		
1	0,902	< 0.01	1	0,897	< 0.01	1	0,553	< 0.01
2	0,879		2	0,793		2	0,757	
3	0,947		3	0,73		3	0,559	
4	0,934		4	0,653				
Egoistic Values						Personal Norms		
1	0,51	< 0.01				1	0,751	< 0.01
2	0,573					2	0,649	
3	0,728					3	0,763	
4	0,502					4	0,549	
5	0,56					5	0,797	

Source: Survey data, 2021.

4.2 HYPOTHESIS TESTING: PATH ANALYSIS

For hypothesis testing, path analysis was employed. In order to verify the distribution of the data, the multivariate normality test of Mardia (1970, 1974) was employed. This test is based on the asymmetry and kurtosis coefficients. The results of the analysis indicated lack of normality in the sample (Mardia’s Multivariate Kurtosis = 179,610 and Multivariate Critical Ratio = 95,657). Thus, as indicated by Byrne (2010), the bootstrapping technique was used in order to rectify the normality problems. From this perspective, the recommendations of Marôco (2010) were used. Therefore, the parameters were estimated through the bootstrapping procedure for 20,000 samples.

As is recommended in the literature (eg. Byrne, 2010; Hair et al. 2014), model fit was evaluated based on the Chi-square to degrees of freedom ratio (CMIN/DF), Normed Fit Index (NFI), Tucker Lewis Index (TLI), Goodness-of-fit Index (GFI), Comparative Fit Index (CFI) and Root mean square error of approximation (RMSEA) and Standardized root mean residual (SRMR) indicators. Table 7 presents these values and the acceptable ranges for each indicator (see Schweizer (2010), Hair et al. 2014).

Table 7 – Model fit indicators and criteria for acceptance

Indicator	Values	Acceptable Range
CMIN/DF	3,47	<3
NFI (Normed Fit Index)	0,942	≥0.9
TLI (Tucker–Lewis Index)	0,952	≥0.9
CFI (Comparative Fit Index)	0,958	≥0.9
GFI (Goodness-of-fi t Index)	0,947	≥0.9
RMSEA (Root Mean Square Error of Approximation)	0,047	<0,08
SRMR (Standardized root mean residual)	0,0473	<0.1

Source: Survey Data, 2021.

Table 7 shows that of all indicators, only CMIN/DF had a non-acceptable value. In this sense, Schweizer (2010) emphasizes that model fit is considered good when the CMIN/DF indicator is less than 2 and is considered an acceptable fit when less than 3. In the data of this research, a value of 3,47 was found. However, this indicator is very sensitive to large samples and cannot be used as the only parameter for the fit (Joreskog, 1969). In large samples, as is the case in this investigation, this indicator loses its significance and can be safely suppressed. Therefore, it is possible to infer that the statistics, when analyzed together, show that the model presents satisfactory adjustment. However, it was found that the R-squared (R2) of relations between constructs did not present a high power to explain the variation in the sample, especially regarding the variables that make up the aegis of values, as shown in Table 87. A possible explanation for this result is the fact that these variables are very complex, making a prediction analysis difficult (Dietz; Fitzgerald; Shwom (2005).

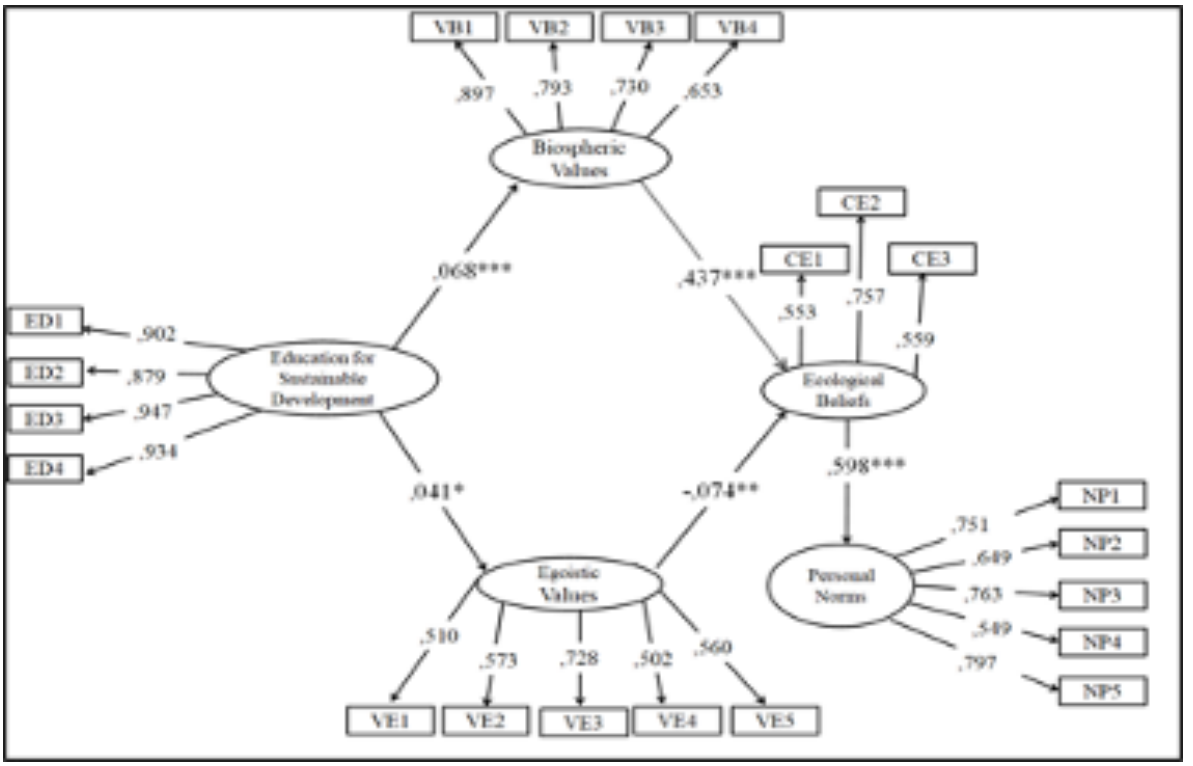
Table 8- R-square (R2)

R-square (R2)	Egoistic Values	Biospheric Values	Ecological Values	Personal Norms
	0,002	0,005	0,197	0,357

Source: Survey Data, 2021.

However, despite these low determination coefficients (R^2), this result does not necessarily represent a limitation (Chalmer, 1986). The intention here was not to predict variable values as a function of others, but rather to relate them in light of the proposed structural model, seeking to find significant relationships, as well as to verify which selected variables positively or negatively impact the analyzed dimensions. A summary of the Path Analysis results is presented in Figure 2.

Figure 2- Results of Path Analysis



*non-significant; ** significant for p<0.1 *** significant for p<0.05
Source: Survey Data, 2021.

The hypothesis test statistics are presented in Table 9. It is noteworthy that due to validation problems in the CFA, the theoretical constructs: altruistic values, hedonic values and utilitarian beliefs were removed from the Structural Equation Modeling. The results indicate that for the first hypothesis of this study, only sub-hypothese H1a was partially accepted, since the level of education for sustainable development was found to positively impact the biospheric values (p-value = 0.037).

This evidence is in line with the suggestions proposed by Whitley et al. (2016) regarding the path that must be taken by universities to promote long-term changes in the personal norms of their student body towards environmental preservation. In this regard, the authors emphasize that efforts should be undertaken to leverage biospheric value orientations in the academic environment. Corroborating in this regard, the studies conducted by Halstead and Taylor (1996) and Lewis, Mansfield and Baudains (2008) signal the crucial role of sustainability education in the process of developing students' environmental values.

Furthermore, evidence was found to suggest that the higher the level of education for sustainable development, the greater the positive effects captured in biospheric values. These results are compatible with those found by Chin et al. (2012) and Castelló-Climent and Hidalgo-Cabrillana (2012) from the perspective that both quality and quantity of education made a difference in the empirical contexts that were investigated.

For the test of the second hypothesis, which relates the effects of values on beliefs about drinking water, it included sub-hypotheses H2a and H2b. Regarding sub hypothesis H2a, the test statistics showed an expected result (p-value < 0.001), as it was found that biospheric values have a positive effect on ecological beliefs about drinking water. These findings are in line with the assumptions of the VBN theory. Furthermore, they are in line with the arguments of Steg, Dreijerink and

Abrahamse (2005), Steg et al. (2014) and Yildirim and Semiz (2019) from the perspective that individuals with biospheric value orientation are expected to have a greater predisposition to renounce and/or sacrifice for the promotion of the well-being of the environment. Therefore, they would be more likely, relative to egoistic values, to have beliefs in favor of water preservation.

It is noteworthy that the sub-hypothesis H2b differs from H2a by relating the effects of hedonic and egoistic values on utilitarian beliefs about drinking water. Due to the low internal consistency of the factors (hedonic values and utilitarian beliefs), these factors were excluded from the Path Analysis, thus canceling the test of this sub-hypothesis. Finally, the third hypothesis, which relates the effects of drinking water beliefs on personal norms, it was divided into two sub-hypotheses: H3a and H3b. In this sense, it was proposed as sub hypothesis H3a that there would be a positive impact of ecological beliefs on personal norms of coping with drinking water scarcity, since for individuals to feel morally obligated to save water, they would need to believe, for example, that water is a scarce resource that must be carefully preserved.

Thus, considering that individuals with antagonistic beliefs to water conservation (utilitarian beliefs) would not feel the moral obligation to make efforts to address drinking water scarcity, since they believe that humans have the right to use all the water they want, we developed the sub hypothesis H3b. It proposes that there would be a negative impact of utilitarian beliefs on personal norms to address drinking water scarcity. However, hypothesis H3b could not be tested, because as demonstrated in the factor analysis, due to the value of Cronbach's Alpha, the utilitarian beliefs dimension had to be excluded.

It is worth noting that the sub-hypothesis H3a was confirmed (p-value < 0.001). Based on the findings by Yildirim and Semiz (2019) and of Zhang et al. (2021), who propose that the personal norm is the most direct and proximal variable to environmental behavior in VBN theory, this finding is in line with the assumptions of VBN theory. It is also consistent with findings by Corral-Verdugo, Bechtel and Fraijo-Sing (2003), Kang et al. (2017), Raeisi, Bijani, and Chizari (2018), Yildirim and Semiz (2019), Moghadam et al. (2020), and Wu and Zhu (2021) who suggest the beliefs dimension as a significant predictor of personal norms.

Table 9- Hypothesis Testing

Hypothesis Testing			Standardized coefficients	p-value
Education	→	Biospheric Values	0,068	0,037
Education	→	Egoistic Values	0,041	0,252
Biospheric Values	→	Ecological Beliefs	0,437	***
Egoistic Values	→	Ecological Beliefs	-0,074	0,057
Ecological Beliefs	→	Personal Norms	0,598	***

***level of significance: P< 0,001

Source: Survey data, 2021.

In summary, of the hypotheses proposed in this research, hypotheses H2b and H3b could not be tested due to the low internal consistency of two dimensions: hedonic values and utilitarian beliefs, these factors were excluded from the analysis. The evidence obtained here indicated that the level of education for sustainable development positively impacted only biospheric values, as well as that ecological beliefs were positively affected by biospheric values. Furthermore, evidence was found that personal water saving norms would have been

positively influenced by ecological beliefs, as shown in Table 10.

Table 10- Status of the proposed hypotheses

Hipotheses	Status
H1a: There is a positive impact of the level of education for sustainable development on altruistic and biospheric values.	Partially accepted
H1b: There is a negative impact of the level of education for sustainable development on egoistic and hedonic values.	Not accepted
H2a: Altruistic and biospherical values have a positive effect on ecological beliefs about drinking water.	Partially accepted
H2b: Egoistic and hedonic values have a positive effect on utilitarian beliefs about drinking water scarcity.	Not tested
H3a: There is a positive impact of ecological beliefs on personal norms of coping with drinking water scarcity.	Accepted
H3b: There is a negative impact of utilitarian beliefs on personal norms of coping with drinking water scarcity.	Not tested

Source: Survey data, 2021.

In this sense, these results allow us to infer that the values of individuals are in fact the guiding principles of their beliefs. In addition, to feel a moral obligation to address the scarcity of drinking water, evidence suggests that students need to believe that this issue is indeed a serious problem for society.

Whitley et al. (2016) point out that it is necessary to consider the influence of the VBN chain in the students' decision-making process, especially when it is desired to promote long-term changes in attitudes regarding environmental issues. The findings suggest the need to develop discussions about the praxis of the fundamentals of education for sustainable development and its implications in the students' confrontation with the scarcity of drinking water. It is hoped that the evidence obtained in this investigation may contribute to stress the need for Higher Education Institutions and regulatory agencies to discuss, in a systematized way, the need to comply with Goal 4.7 of the Sustainable Development Goals for education.

Another aspect that deserves attention is the urgency of achieving Target 6.1 of the Sustainable Development Goals, which calls for universal and equitable access to safe and affordable drinking water for all. Based on the assumption that people need to make 'the sustainable choice' on a daily basis, in the personal, corporate, and governmental spheres, it is of utmost relevance that educational policies that contribute to effective changes in the field of water governance are instituted. Despite all the limitations imposed by the capitalist system, education should be: "above all a political act aimed at social transformation" (Jacobi, 2003, p. 8). Therefore, it is expected that the results documented in the present study will contribute to highlight how necessary it is to expand this academic topic, which is dynamic and complex, through the discussion of intersectional power relations in the field of education for sustainable development and its implications for the governance of water resources, since the problem of scarcity of drinking water affects all aspects of life in society.

5 CONCLUSIONS

The purpose of this study was to investigate the effects of education for sustainable development on university students' personal norms regarding drinking water scarcity under the framework of VBN theory. The data collection instrument was validated qualitatively (semantic validation of translated items) and quantitatively (internal consistency and CFA). For hypothesis testing, path analysis was employed.

The research results indicated that the level of education for sustainable development pos-

itively impacted only biospheric values. The findings demonstrate that the impact of education for sustainable development depends on its quality, quantity, distribution, and diffusion in curricula. The evidence is in line with the assumptions of value-belief-norm theory and suggests that individuals' values are in fact guiding principles of their beliefs. Biospheric values were found to have a positive effect on ecological beliefs.

Nevertheless, it was found that, in order to feel morally obligated to cope well with drinking water scarcity, students need to believe that drinking water scarcity is in fact a serious problem for society. The analysis of effects the dimension "level of education for sustainable development" in individuals' values impacting the VBN chain is an original contribution of this study. The adapted scale presents potential contributions to the improvement of the level of education for sustainable development in other contexts, beyond the higher education level (for example, we can mention elementary and high school), by providing subsidies for the diagnosis of the institutional performance regarding the level of education that is being achieved in comparison with the desired one.

The evidence also presents potential contributions to the teaching-learning process, in the sense that it signals to teachers the importance of values-based education. In this approach, efforts should be made to understand the predominant value orientations of students. Based on this diagnosis, subsidies should be created in order to adapt and/or develop more assertive teaching-learning strategies regarding the promotion of sustainable development.

Moreover, for the students, acknowledging the value orientations that guide their beliefs is a promising opportunity to critically rethink the assumptions that contributed to the internalization of these orientations and the impact of these processes on their sense of responsibility towards the promotion of sustainable development. This could contribute to provide a favorable environment for the deconstruction and/or dialogical and emancipatory construction of knowledge.

From this perspective, based on the results of student evaluation, policy makers, educational managers, and course coordinators will have important subsidies to identify which indicators of the measure of "education level" presented here need to be improved. Therefore, they might be able to outline more assertive intervention strategies in order to help individuals become more aware of their responsibilities and adopt differentiated behavioral attitudes for the promotion of sustainable development.

In addition to the aforementioned socio-environmental benefits, it is noteworthy that to foster discussions that contribute to the increase in the level of education for sustainable development has the potential of ensuring that future professionals may be better prepared to deal with sustainability-related issues and their possible solutions in the corporate environment. This might result in economic benefits and competitive advantage (eco-efficiency, value creation, an increase in market share, reduction of risks, liabilities, and cost of capital).

In this sense, given the deleterious Brazilian water crisis scenario, this study, by presenting a consistent scale to measure personal norms for coping with the scarcity of drinking water, provides subsidies for Higher Education Institutions, as well as public policy makers. It might help them evaluate the effectiveness of actions seeking to increase the sense of accountability of individuals regarding the problem of scarcity of drinking water.

Among the limitations of this study, the R-squared (R^2) of the theoretical dimensions did not show a high explanatory power, especially with regard to the variables that make up the value base, indicating that the variation in the sample might have occurred due to other factors. From this perspective, undertaking efforts to capture the effects of other predictors of individuals' values in countries with different economic, cultural, social, and environmental conditions, by means of a cross-national study, may also be a promising research opportunity.

Furthermore, other proxies could be used to measure the level of education for sustainable development, such as the classification proposed by the United Nations "Principles for Responsible Management Education" (PRME) platform. Further studies could use other qualitative methodological procedures, such as interviews and focus groups in order to more robustly understand the issues addressed in this research, as well as investigate the influence of sociocultural, spiritual, and institutional values in addressing the scarcity of drinking water. Furthermore, it is suggested that the phenomenon in question be studied from the perspective of course coordinators, professors, and undergraduate students.

Finally, further studies of an experimental nature are recommended. Exploring the influence of the priming effect on students' personal norms may be an interesting research opportunity. Another promising possibility would be to investigate the effect of variables such as level of knowledge, course type, political stance, gender, and income on student attitude. In addition, it is recommended that Multigroup Confirmatory Factor Analysis (MCFA) be conducted to identify, for example, the potential effects of courses where curricula are more sensitive to environmental issues than others. Moreover, additional empirical evidence is needed to validate the "Education for sustainability" subscale, together with EFA.

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1. Definition of research problem	√	√	√	√	√
2. Development of hypotheses or research questions (empirical studies)	√	√	√	√	
3. Development of theoretical propositions (theoretical work)	√	√	√	√	
4. Theoretical foundation / Literature review	√	√	√	√	
5. Definition of methodological procedures	√	√	√	√	√
6. Data collection	√		√	√	√
7. Statistical analysis	√		√	√	
8. Analysis and interpretation of data	√	√	√	√	√
9. Critical revision of the manuscript	√	√	√		
10. Manuscript writing	√	√	√	√	√
11. Other (please specify)					

Conflict of Interest

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