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Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions



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ABSTRACT

This study relied on the theory of planned behavior (TPB) to identify the beliefs that influence young people's pro-environmental behavior. High-school students completed a questionnaire regarding the performance of pro-environmental behaviors early in the school year and reported on their behavior toward the end of the year. In addition to the standard TPB constructs, the initial questionnaire assessed descriptive norms, moral norms, sex, and empathic concern. Results revealed an excellent fit for the standard TPB model; attitudes, descriptive subjective norms, and perceptions of control made independent contributions to the prediction of intentions, and intentions together with perceived control predicted behavior. Behavioral, normative, and control beliefs predicted, respectively, attitudes, subjective norms, and perceived behavioral control. Empathic concern influenced intentions and behavior indirectly by its effects on behavioral, normative, and control beliefs. Examination of the effects of specific beliefs revealed important implications for designing effective behavior-change interventions.

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1. Introduction

People are called to change their behavior in an effort to reduce its detrimental impact on the environment (see Gifford & Nilsson, 2014). In this regard, young people are a critical stakeholder, since they bear the burden of past and current negligence towards the environment. At the same time, they represent a powerful engine for behavior change. However, research suggests that although some young people respond to environmental threats with enhanced civic engagement, personal responsibility, and a sense of collective efficacy, others respond negatively with disinterest or denial (Doherty & Clayton, 2011; Reser & Swim, 2011). Moreover, young people are more reluctant to commit to pro-environmental behavior (PEB) than older people, despite often holding more favorable environmental attitudes (Grønhøj &

Thøgersen, 2012). Thus, developing a more thorough understanding of what motivates pro-environmental behavior (PEB) among young people is an important area of concern that has practical applications for creating a sustainable future (e.g. Fielding & Head, 2012; Gifford & Nilsson, 2014; Johnson, Johnson-Pynn, Luguemya, Kityo, & Drescher, 2013; Toth, Little, Read, Fitton, & Horton, 2013; Wiernik, Ones, & Dilchert, 2013).

Developing this kind of knowledge is crucial for creating sound educational interventions that aim to foster PEB (Gifford, Steg, & Reser, 2011). However, it is recognized that simply transmitting knowledge is not enough to change lifestyles and behavioral patterns (Gifford & Nilsson, 2014; Sterling, 2010; Stern, 2011). Ajzen, Joyce, Sheikh, and Gilbert Cote (2011) showed that having accurate information about an issue can be quite irrelevant for decision-making. They argued that instead of trying to make sure that people have accurate information, we need to identify the subjective beliefs people hold towards the issue and how these beliefs affect their intention and behavior. Only then is it possible to either challenge beliefs that impede the adoption of the desired behavior, strengthen those who support it, or facilitate the development of new beliefs that promote the desired behavior. Unfortunately, no

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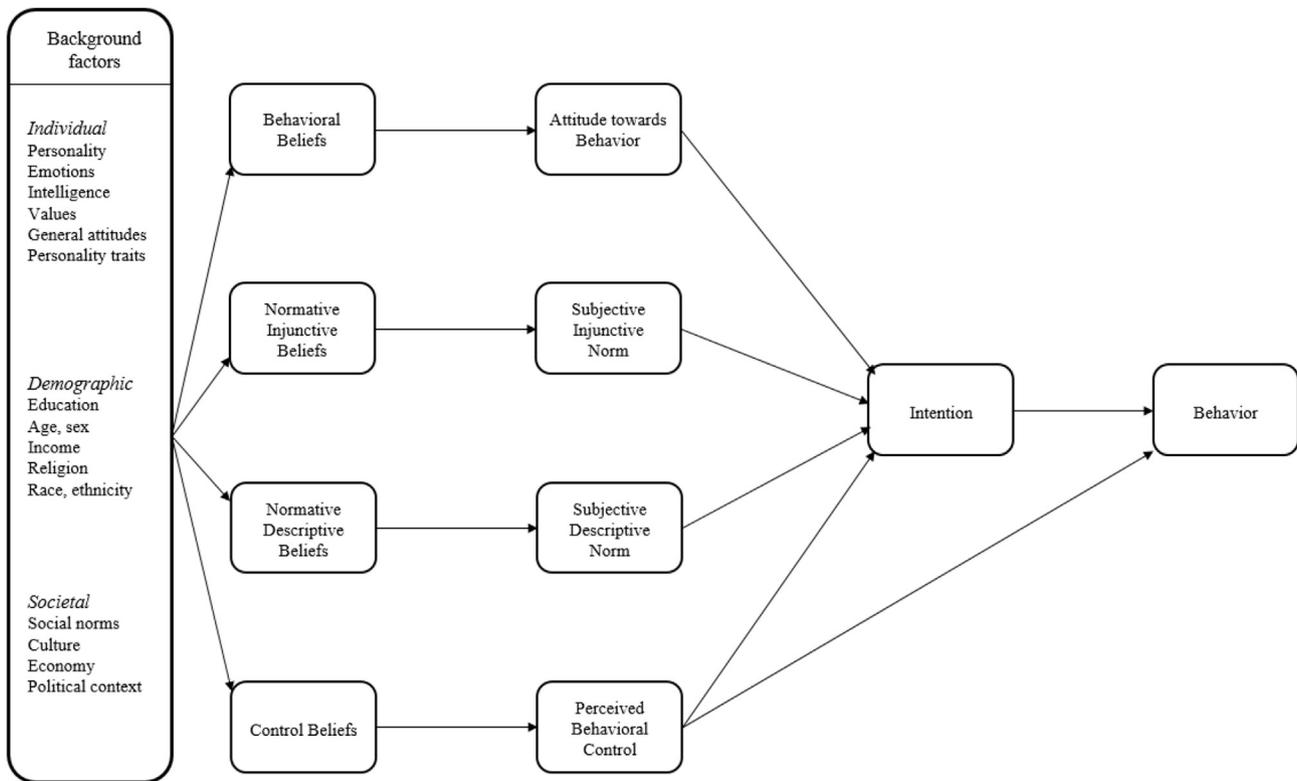


Fig. 1. The theory of planned behavior model.

research has identified key beliefs in relation to PEB among young people. To fill this gap, we conducted a study based on the theory of planned behavior (TPB). This popular and validated social-cognitive model of human behavior is well suited to identify the beliefs that can be used to inform pro-environmental behavior change interventions (for more details, see the meta-analyses of Bamberg and Möser, 2007; Hines, Hungerford, and Tomera, 1986/87; Klöckner, 2013).

1.1. Theory of planned behavior

According to the TPB (see Fig. 1), intentions to perform eco-friendly behaviors and perceived behavioral control are the immediate antecedents of PEB. Perceived control can have a direct effect on behavior¹ and it can also influence behavior indirectly by its effect on intentions. The TPB also postulates that one's intention to adopt PEB should increase to the extent that one holds favorable attitudes towards PEB, thinks that significant others support these behaviors (i.e. injunctive norm) or adopt PEB themselves (i.e. descriptive norm), and perceives to have control over these behaviors.

Attitudes towards a behavior are assumed to be based on behavioral beliefs, which are a person's beliefs about the likely consequences of performing the behavior (Ajzen, 1991, 2005). When high-school students believe that adopting environmentally sustainable behaviors mainly produces positive outcomes, their

attitude towards these behaviors will be favorable. Conversely, if they associate PEB with mainly negative consequences, their attitude will be unfavorable. Similarly, injunctive norms are based on people's perception of what important referents (e.g. parents, teacher, close friends) think they ought to do, while descriptive norms are based on beliefs concerning these significant referents' own behavior (Rivis & Sheeran, 2003). In their 2010 monograph, Fishbein and Ajzen formally added descriptive norms to injunctive norms as a second component of subjective norms. The influence of descriptive norms on behavior has been studied extensively by Cialdini and his associates (e.g., Cialdini, 2001; Kallgren, Reno, & Cialdini, 2000) and incorporated into many studies that use TPB as a guiding framework (e.g., Rivis & Sheeran, 2003). It was also integrated in studies interested in understanding environmental behaviors (e.g., Heath & Gifford, 2002; Nigbur, Lyons, & Uzzell, 2010; Onwezen, Bartels, & Antonides, 2014). Finally, perceived control is a result of control beliefs, which are perceptions about the presence of factors that facilitate or impede the adoption of a given behavior.

Gifford (2014) argued that despite TPB's extensive use and attractive parsimonious account of PEB, there are concerns about its incompleteness. For example, the results of a meta-analysis across different behavioral domains (Rivis, Sheeran, & Armitage, 2009) support the role of moral norms as a significant predictor of intention. The same conclusion emerged in three meta-analyses in the environmental domain (Bamberg & Möser, 2007; Hines et al., 1986/87; Klöckner, 2013). Moreover, Fishbein and Ajzen (2010) argued that when dealing with behaviors that have a clear moral dimension, it is warranted to include a measure of moral norm in the TPB model to determine whether it adds to the prediction of intention and behavior. In the present study, we therefore considered moral norms as an additional proximal determinant of intention.

¹ Theoretically, perceived behavioral control—to the extent that it accurately reflects actual control—is, like actual control, expected to moderate the effect of intention on behavior (see Ajzen, 2012). However, empirical research generally supports a linear combination, rather than an interaction, of intentions and perceived control.

1.2. Background factors: sex and empathic concern

The TPB also proposes that a multitude of background factors (e.g., age, sex, ethnicity, socioeconomic status, education, personality, past experiences) can potentially influence the beliefs people hold. Thus, to gain further insight into the underlying reasons for the adoption of PEB among young people, we examined the potential impact of two background factors, sex and empathic concern. It seems likely that people who vary in terms of sex and empathic concern may have been exposed to different experiences and thus may have formed different PEB-relevant beliefs (Fishbein & Ajzen, 2010). These differences would be expected to influence their pro-environmental intentions and actions.

Findings regarding sex differences in PEB are inconsistent (see Gifford, 2014; Xiao and McCright, 2014 for details). In fact, although many studies have documented significant sex differences, with women generally reporting greater eco-friendly intentions and behavior than men (e.g., Cincera & Krajhanzl, 2013; de Leeuw, Valois, Morin, & Schmidt, 2014; Fielding & Head, 2012; Zelezny, Chua, & Aldrich, 2000), other studies (e.g., Hadler & Haller, 2011; Hunter, Hatch, & Johnson, 2004; Tindall, Davies, & Mauboules, 2003; Xiao & Hong, 2010) have found no sex differences. According to the TPB, differences in intentions and behavior between men and women may be the result of divergent behavioral, normative, and/or control beliefs which affect the proximal antecedents of intentions, that is, attitudes, subjective norms, and perceptions of behavioral control (Ajzen, 2005).

We considered empathic concern as a second background factor of potential importance. According to Batson, Chang, Orr, and Rowland (2002), empathic concern arises when an entity—whether a human or the natural environment—is oppressed or in need. This concern includes feelings of sympathy, compassion, and tenderness. Indeed, research has shown that individuals who are more empathic and less self-focused are more likely to develop a personal connection with nature, which in turn predicts their pro-environmental attitudes (Bragg, 1996; Mayer & Frantz, 2004). Developing an emotional affinity toward the natural environment can bolster one's motivation for environmental protection (Kals, Schumacher, & Montada, 1999). Others researchers have found that empathic concern correlates with pro-environmental attitudes, including attitudes towards animal welfare (Schultz, 2000; Taylor & Signal, 2005). Although these investigators used scales that assess feelings of empathy towards humans, the results suggest that empathic concern can also be felt toward the environment, hence motivating people to protect it (Berenguer, 2007; 2010). As in the case of sex, according to the TPB, when empathic concern is introduced as a background factor it can influence eco-friendly intentions and behavior indirectly by its effects on beliefs that provide the basis for attitudes, subjective norms, and perceived control.

Understanding how sex and empathic concern may affect pro-environmental behavior by their influence on the beliefs that give rise to attitude, subjective norm, and perceived behavioral control may be particularly important for the development of pro-environmental educational interventions targeting young people (Ajzen & Klobas, 2013).

1.3. The present study

As part of a larger research project examining the utility of the extended TPB within the context of primary, secondary, and university students' PEB, the purpose of the current study was three-fold. The first aim was to predict and explain young people's self-reported pro-environmental behavior with the extended theory of planned behavior. A second aim was to identify the beliefs about

PEB that are most important and relevant for secondary students. Such belief-based analyses can inform the development of behavior change interventions for young people to adopt pro-environmental behavior. The third aim was to examine the effects of gender and empathic concern on pro-environmental beliefs, attitudes, intentions, and behavior. Accordingly, we developed the following hypotheses:

- 1 The constructs of the extended TPB measured early in the school year predict the self-reported eco-friendly behavior in the course of the year.
- 2 In accordance with the TPB, we expect significant relations between (a) beliefs about the advantages/disadvantages of adopting PEB (behavioral beliefs) and the attitude towards adopting PEB, (b) beliefs about the perceived support by others (injunctive and descriptive normative beliefs) and the general subjective norm, and (c) beliefs about the presence of factors that can facilitate or impede performance of PEB (control beliefs) and perceived behavioral control. No research has suggested which of the underlying beliefs will influence the attitude, subjective norm and perceived behavioral control most. Thus, no specific hypothesis is formulated regarding which specific belief will be related to attitude, subjective norm and perceived behavioral control.
- 3 Sex (1 = male; 2 = female) and empathic concern are expected to be positively related to eco-friendly intentions and behavior, these effects being indirect, operating via behavioral, normative, and/or control beliefs and the proximal antecedents of intentions.

2. Method

2.1. Pilot study

According to the TPB, behavioral, normative, and control beliefs that are readily accessible in memory constitute the prevailing considerations that ultimately guide intentions and actions. It would therefore be inappropriate to assess the extent to which participants endorse a preconceived list of belief statements. Instead, it is incumbent on investigators to identify the beliefs that spontaneously come to mind when participants think about the behavior of interest. An arbitrarily or intuitively selected set of belief statements will tend to include associations that are not readily accessible in the population (Ajzen, 1991). Similarly, a belief scale developed, for instance, in another country or in a different context may not represent the key beliefs that are shared by the target population.

Readily accessible beliefs must be elicited from a sample of respondents that is representative of the research population. Therefore, in accordance with recommended practices (see Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2010), we conducted a pilot study in which an open-ended questionnaire was administered to determine students' readily accessible beliefs about PEB.

The pilot sample consisted of 92 high-school students (41 females; age range 13–16, $M = 14.02$, $SD = .73$) recruited from five high schools in Luxembourg. They were told that the investigators were interested in their opinions about PEB and were given examples (e.g., switching off lights when leaving a room, placing trash in the correct recycling bin, turning off the faucet while brushing teeth, etc.). They were then asked to write down the thoughts that came to mind in relation to performing these kinds of behaviors. Specifically, they were asked to list (a) the advantages and disadvantages of performing these behaviors in the next year, (b) the persons or groups of people who would approve or disapprove of their performing these behaviors in the next year, and (c) the

factors that could facilitate or interfere with their performing these behaviors in the next year.

A content analysis of the responses was conducted to determine the most readily accessible beliefs in the population by counting the number of times a given response had been emitted. This procedure includes four steps. In the first step, two judges independently examined the participants' written responses to the open-ended questions and identified the semantic units (Castro, Kellison, Boyd, & Kopak, 2010). These semantic units could either represent the advantages and disadvantages associated with the adoption of the PEB, significant others which could support or oppose adopting PEB, or factors that could impede or facilitate the adoption of PEB. In the second step, the judges independently classified the semantic units into generic categories. Semantic units that related to one overarching theme were classified in the same category. In addition, the judges met with an expert in TPB to discuss the categories (Patch, Tapsell, & Williams, 2005). For example, some categories could be merged, renamed, while others that were too general could be divided into more specific categories. In step three, both judges independently reclassified the semantic units in the final categories that emerged from step two. Cohen's kappa was then calculated in order to determine the extent to which the judges classified the semantic units in the same categories (French & Cooke, 2012). In the fourth and final step, the judges calculated the number of semantic units in each category. Then, the Spearman correlation (i.e., degree of agreement concerning rank classification) and the interclass correlation (i.e., inter-judges agreement concerning the magnitude of the frequencies) were calculated to verify the level of agreement on the number of times the semantic units were reported by the participants. This last step was used to determine the most frequently expressed beliefs and allowed us to make a decision concerning "how many of the identified beliefs to include in the modal set" (Fishbein & Ajzen, 2010, p. 103).

Results showed that the two researchers agreed on the most frequently cited advantages ($\rho = .92, p < .001$; ICC = .99, $p < .001$) and disadvantages ($\rho = .79, p < .01$; ICC = .80, $p < .01$) of adopting pro-environmental behavior, the most important normative referents or groups of referents ($\rho = .99, p < .05$; ICC = .96, $p < .001$), and the most frequently elicited facilitators ($\rho = .81, p < .05$; ICC = .78, $p < .05$) and barriers ($\rho = .81, p < .05$; ICC = .88, $p < .01$). The most frequently cited outcomes, referents, and control factors were used to develop the quantitative measures of behavioral, normative, and control beliefs for the main study.

Prior to conducting the main study, a pretest was conducted to test the psychometric qualities of the TPB constructs. The sample was composed of 108 students drawn from five high schools in Luxembourg (55 female, aged 12 to 16, $M = 14.25, SD = .77$). Item response theory analyses and classical test theory analyses (Cronbach's alpha coefficients varying from .66 to .92 with a median of .84) indicated that the scales were all adequate.

2.2. Main study

2.2.1. Procedure

Participants for the main study were drawn from nine high schools in Luxembourg. Of the 713 eligible students, 602 (292 female, aged 12 to 16, $M = 13.61, SD = .66$) completed both of two questionnaires. The first questionnaire, administered during the initial trimester of the school year (October to December 2012), assessed all predictor variables. The second questionnaire, which obtained self-reports of PEB, was administered during the final trimester (April to June 2013). Participants were assured of their anonymity and they completed each questionnaire in the context of a 50-min classroom sessions. Two research assistants were present to support the students. To generate a unique identifier to match

the two questionnaires, participants were asked to provide their birthdate and the first three letters of their mother's first name.

2.2.2. Questionnaires

The questionnaire administered at the first session assessed the constructs of the TPB, and emphatic concern, with sex as a demographic variable. As in the pilot study, participants in the main study were given examples of PEB and were then asked to respond to a series of questions in relation to the performance of such behaviors.

2.2.2.1. Beliefs. Behavioral beliefs. A list of 12 potential outcomes was presented to assess students' beliefs about the consequences of adopting PEB. Participants rated the likelihood that adopting PEB would produce each of the outcomes on a 6-point scale ranging from "definitely not" to "yes, definitely", and they rated the importance of each outcome on a 6-point scale from "not important at all" to "very important". Among the outcomes were "I would help protect animals" "I would help protect our natural environment" and "It would decrease my quality of life". The overall behavioral beliefs score is obtained according to an expectancy-value model (Fishbein & Ajzen, 2010), in which the score for the likelihood of an outcome is multiplied by the score of its importance. This is expressed symbolically by the following equation: $A = \sum b_i e_i$, where A is the attitude toward the eco-friendly behavior under consideration, b_i is the strength of belief i that performing the behavior will produce outcome i , e_i is the evaluation of outcome i , and the sum is the overall readily accessible beliefs.² Note that the same expectancy-value model is used to obtain the overall score of each belief-based measures described below.

Injunctive normative beliefs. To measure injunctive normative beliefs, students were asked to indicate: (1) to what extent they thought that nine specific important others (e.g., parents, friends, teachers, classmates) expected them to adopt PEB, and whether the students were motivated to comply with these expectations (injunctive normative beliefs). All items were rated on 6-point scales ranging from "definitely not" to "yes, definitely".

Descriptive normative beliefs. The measure for descriptive normative beliefs was obtained by asking student whether they believed that these nine important others would themselves adopt PEB during the next year, and whether they considered these important others to be behavioral role models (descriptive normative beliefs). All items were rated on 6-point scales ranging from "definitely not" to "yes, definitely".

Control beliefs. The questionnaire addressed 12 control factors, such as the presence of recycling bins at home and at school, and getting examples and explanations of PEB at school. With respect to each factor, participants rated its occurrence likelihood (e.g., "I think that the following situations will occur during the next year") as well as its perceived facilitating value (e.g., "During the next year, the presence of the following situation would help me adopt pro-environmental behaviors on a regular basis"). Ratings were made on 6-point scales ranging from "definitely not" to "yes, definitely".

2.2.2.2. Proximal determinants of intention and behavior. The measures described below were adopted from de Leeuw et al. (2014).

Attitude toward PEB. To assess attitudes toward eco-friendly behavior, participants evaluated the common stem, "For me,

² There is no reason to assume that beliefs are internally consistent. People can and often do hold contradictory beliefs, both positive and negative, about a given behavior. It is therefore inappropriate to compute an internal consistency coefficient, such as Cronbach's alpha, for a set of beliefs.

performing pro-environmental behaviors on a regular basis during the next year would be ..." on eight 6-point bipolar adjective scales, such as "useless – useful", "annoying – pleasant", and "cool – uncool". Responses were aggregated to yield a measure of attitude (Cronbach's $\alpha = .87$).

Injunctive norms. Responses to two questions were used as reflective indicators of injunctive norms ($r = .79$) (e.g., "In general, people who are close to me expect me to adopt pro-environmental behaviors on a regular basis during the next year"). Participants rated each item on a 6-point scale ranging from "definitely not" to "yes, definitely".

Descriptive norms. As for injunctive norms, responses to two questions were used as reflective indicators of descriptive norms ($r = .83$) (e.g., "People who are important to me will perform pro-environmental behaviors on a regular basis during the next year"). Participants rated each item on a 6-point scale ranging from "definitely not" to "yes, definitely".

Perceived behavioral control. The mean of two items ($r = .81$) was used to assess perceived behavioral control. Participants rated, on 6-point scales, "For me, performing pro-environmental behaviors on a regular basis in the next year would be:" ("very difficult" to very easy), and "I feel that I'm able to perform pro-environmental behaviors on a regular basis in the next year" ("definitely not" to "yes, definitely").

Moral norms. Following the stem, "If I performed pro-environmental behaviors on a regular basis during the next year ..." participants were asked to respond to four items: "I would show respect for humans and the earth," "I think that I would be a responsible person," "I would feel like I'm doing something morally right," and "I would have a good conscience". In addition, they were asked whether they felt a moral obligation to adopt pro-environmental behaviors on a regular basis during the next year and whether their personal values prompted them to perform pro-environmental behaviors on a regular basis during the next year. All six items were rated on 6-point scales ranging from "definitely not" to "yes, definitely", and responses were aggregated to obtain a measure of moral norm (Cronbach's $\alpha = .84$).

Empathic concern. We administered the empathic concern scale from the Interpersonal Reactivity Index (Davis, 1980). It consisted of seven items, such as, "I often experience warm, caring feelings for people who are less well off than I" and "The bad luck of others usually doesn't affect me much." Responses were provided on 5-point scales that ranged from "doesn't describe me well" to "describes me very well." The French version was adopted from Lussier (1996) and the German version from Paulus (2007). Both versions were also administered in the pretest and modified subsequently according to the participants' questions and feedback. The average response to the seven items constituted our measure of empathic concern (Cronbach's $\alpha = .68$). When comparing groups (i.e. Student *t*-test) or introducing empathic concern as a background variable into the TPB, median split was performed in order to create a dichotomous variable with 1 (below median) representing low empathic concern, and 2 (above median) high empathic concern.

2.2.2.3. Dependent variables. Intention. Intentions were assessed by computing the mean response to the following two items ($r = .89$): "I am determined to perform pro-environmental behaviors on a regular basis in the next year" and "I have the will to perform pro-environmental behaviors on a regular basis during the next year." Responses were provided on 6-point scales ranging from "definitely not" to "yes, definitely."

Behavior. The second questionnaire administered toward the end of the school year contained 13 questions designed to assess the extent to which the participants had performed eco-friendly behaviors during the period since last Christmas (i.e., after administration of the first questionnaire). On 5-point scales ranging

from 0 (never) to 5 (always) participants indicated how often they had performed each of the behaviors (see Table 1 for the complete list of PEB). Responses to the 13 questions were averaged to yield a measure of behavior (Cronbach's $\alpha = .72$).

2.2.3. Statistical analyses

Missing data. Of the 602 participants, 305 (50.7%) completed all questionnaire items, whereas 297 omitted responses to one or more items: 1 missing value ($n = 136$; 22.6%); 2 to 5 ($n = 145$; 24.1%), 6 to 10 ($n = 11$; 1.8%), 11 to 13 ($n = 5$; .8%). To correct for missing data, we used a multiple imputation procedure (Allison, 2001) which takes full advantage of the available data and avoids some of the biases in standard errors and test statistics that can accompany traditional *ad hoc* methods such as listwise or pairwise deletion or mean-substitution (Peugh & Enders, 2004). Starting with simple random values, values were imputed by iteration over the conditionally specified models (van Buuren, 2010). We used a fully conditional specification method called multivariate imputation by chained equations (MICE) (van Buuren & Groothuis-Oudshoorn, 2011) in the R statistical package (R Development Core Team, 2011).

Analyses. Statistical analyses were performed in three steps. First, we tested the original TPB model compared to the expanded TPB model that included moral norms (hypothesis 1). The aim was to identify significant predictors of pro-environmental intentions and behavior and to assess the relations between the belief composites (computed in accordance with the expectancy-value model) and the proximal determinants of intentions, that is, attitude, injunctive norms, descriptive norms, and perceived behavioral control. We included the belief composites in the TPB model rather than the individual beliefs because, according to the TPB, the total sets of behavioral, normative, and control beliefs correlate, respectively, with attitudes, subjective norms, and perceptions of control. Also, using the individual beliefs would have led to a model with too many parameters. Our data set is not large enough to allow for reliable estimation of all parameters of the underlying model.

Second, in order to gain a better understanding of the most important beliefs, we identified individual beliefs that significantly predicted students' attitudes, injunctive norms, descriptive norms, and perceived control (hypothesis 2). More specifically, we used a multiple indicators and multiple causes (MIMIC) model (Kline, 2011) to explore whether individual beliefs contributed to the prediction of their respective construct, for instance, attitude predicted by the 12 behavioral beliefs (i.e., the 12 expectancy-value products). This switch from a reflective model (i.e. test of all beliefs as a composite in the sense that they all measure a latent belief construct) to a MIMIC model was made to determine whether certain beliefs would more strongly predict pro-environmental attitudes, injunctive norms, descriptive norms, and perceived control.

Third, we introduced the background variables "sex" (1 = male; 2 = female) and "empathic concern" (1 = low empathic concern; 2 = high empathic concern) into the TPB to determine whether these variables affect behavior indirectly (i.e., mediated through the TPB variables) or whether sex and empathic concern would also have significant direct effects on behavior over and above intentions and perceived control (i.e., not fully mediated) (hypothesis 3). On an exploratory basis, we also examined whether gender and empathic concern influenced behavioral, normative, and control beliefs, and whether they moderate the association between individual beliefs and their respective constructs (using MIMIC models).

The different models were tested by means of structural equation methods (SEM) using Mplus 6.0 (Muthén & Muthén, 1998–2010). In order to conduct SEM with latent variables, it is

Table 1
Pro-environmental behaviors scale.

	M female	M male	M total
1. I leave the water running while I brush my teeth ^a	3.18	3.12	3.15
2. I forget to turn off the light when I leave my room to go eat ^a	2.78	2.85	2.82
3. I leave the fridge door open while I think about what I go eat ^a	1.54	1.80	1.67
4. At home, I put my trash in the proper recycling bin	3.04	3.08	3.06
5. I use both sides of the paper sheet when I draw or print a document	2.57	2.47	2.52
6. At school, I put my trash in the proper recycling bin	3.23	3.16	3.19
7. I leave the TV on while I'm doing other things in the house ^a	2.08	2.05	2.06
8. I turn off the TV or the video game when I go eat	2.44	2.05	2.24
9. I shower for more than 20 min ^a	1.79	2.45	2.13
10. When I'm outside, I avoid littering	2.91	2.86	2.89
11. When I'm cold, I put on a sweater instead of turning up the heat	2.53	2.24	2.38
12. I read documents or books about environmental or animal protection	1.38	1.35	1.37
13. I consume biological products	1.64	1.66	1.65

^a These items are recoded.

recommended to use multiple indicators for each variable, because scores from multiple indicators tend to be more reliable and valid than those from a single indicator (Kline, 2011). The constructs were defined using two parcels, with each parcel representing a random subset of the scale items (Bandalos & Finney, 2001; Nasser & Takahashi, 2003), except for injunctive norms, descriptive norms, perceived control, and intention, for which each of the two items employed was used as a single indicator. The background factors sex and empathic concern were introduced as dichotomous variables. We used maximum likelihood estimation with robust standard errors (MLR), which are robust with respect to non-normal distribution of scores (Muthén & Muthén, 1998–2010).

Given the known oversensitivity of the chi-square test to sample size, minor deviations from normality, and minor model misspecifications, model fit is usually assessed with sample size-independent fit indices such as the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean squared error of approximation (RMSEA). According to conventional rules of thumb (Hu & Bentler, 1999; Kline, 2011), acceptable and excellent model fit is indicated by CFI and TLI values greater than .90 and .95, respectively, and by RMSEA values smaller than .08 and .06, respectively. For the comparison of the predictive power of individual behavioral, normative, and control beliefs across groups (i.e. girls vs. boys; high empathic concern vs. low empathic concern), the factor loadings for each latent construct (i.e., attitude, subjective norms, and perceived behavioral control) were constrained to be the same in both groups and the means of the latent constructs were set to be zero across groups. Subsequently, we assessed the

reasonableness of added constraints, in which the predictive power of each belief was progressively constrained to be the same across the subgroups of participants. According to Cheung and Rensvold (2002) and Chen (2007), when using structural equation modeling, the imposition of additional constraints is justifiable if it results in a ΔCFI of .01 or less and a $\Delta RMSEA$ of .015 or less between a more restricted model and the preceding one in the case of samples larger than 300.

3. Results

3.1. Descriptive statistics

Participants ($n = 602$) reported moderately strong intentions to regularly perform PEB ($M = 3.90$, $SD = 1.08$), positive attitude ($M = 4.13$, $SD = .78$), moderately high perceived social pressure (injunctive norms: $M = 3.83$, $SD = 1.09$; descriptive norms: $M = 3.87$, $SD = 1.07$), and moderately high perceived control ($M = 3.94$, $SD = .94$) (Table 2). Their feelings of moral obligation to adopt eco-friendly behaviors was quite high ($M = 4.46$, $SD = .79$), and at session 2 they reported having behaved “regularly” to “often” in a pro-environmental manner ($M = 2.37$, $SD = .57$). Participants also had a moderately high mean empathic concern score ($M = 2.72$, $SD = .67$).

Looking at the effect of sex, t -tests indicated that males and females differed significantly in their intentions, attitudes, and moral norms with respect to regular PEB in the next year. On average, females had slightly stronger intentions ($M = 4.01$,

Table 2
Means, standard deviations and correlations between all variables.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Attitude	4.13 ^a	.79	–	.50**	.50**	.61**	.49**	.39**	.52**	.40**	.55**	.15**	.38**	.62**	.38**
2. Injunctive norms	4.05 ^a	.98		–	.55**	.49**	.45**	.37**	.64**	.45**	.53**	.06	.26**	.51**	.27**
3. Descriptive norms	3.88 ^a	1.03			–	.62**	.36**	.48**	.57**	.47**	.58**	.07	.23**	.66**	.36**
4. Perceived control	3.94 ^a	.94				–	.39**	.40**	.52**	.41**	.60**	.07	.28**	.72**	.38**
5. Behavioral beliefs	2.65 ^b	1.94					–	.34**	.42**	.40**	.48**	.10*	.35**	.44**	.28**
6. Descriptive beliefs	4.38 ^c	5.39						–	.44**	.40**	.41**	.09*	.21**	.49**	.40**
7. Injunctive beliefs	3.83 ^c	6.09							–	.44**	.51**	.09*	.26**	.55**	.29**
8. Control beliefs	4.63 ^c	4.36								–	.52**	.10*	.31**	.48**	.33**
9. Moral norms	3.82 ^a	.67									–	.12**	.41**	.75**	.40**
10. Sex	–	–										–	.35**	.10*	.04
11. Empathic concern	2.72 ^a	.67											–	.36**	.24**
12. Intentions	3.90 ^a	1.02												–	.38**
13. Behavior	2.37 ^a	.57													–

* = $p < .05$ level, ** = $p < .01$ level.

^a Theoretical range = 1 – 6.

^b Theoretical range = –9 – 9.

^c Theoretical range = –21 – 21.

$SD = .93$) than males ($M = 3.79, SD = 1.09; t = 2.55, dl = 600, p < .01$; Cohen's $d = .22$), more positive attitudes ($M = 4.25, SD = .71$ versus $M = 4.02, SD = .83; t = 3.61, dl = 600, p < .0001$; Cohen's $d = .30$), and they felt a slightly stronger moral obligation to behave pro-environmentally ($M = 3.90, SD = .64$ versus $M = 3.75, SD = .69; t = 2.79, dl = 600, p < .01$; Cohen's $d = .23$). No difference was found in perceived social pressure (i.e., injunctive and descriptive norms), perceived behavioral control, or self-reported PEB.

Regarding the effect of empathic concern, t -tests indicated that participants with low empathic concern (LEC; below median) and high empathic concern (HEC; above median) differed significantly on all TPB constructs and on moral norms. On average, students with HEC had more positive attitudes (LEC: $M = 3.90, SD = .74$; HEC: $M = 4.40, SD = .75; t = -8.19, dl = 600, p < .0001$; Cohen's $d = .67$), felt stronger social pressure due to normative expectations (LEC: $M = 3.87, SD = .96$; HEC: $M = 4.36, SD = .96; t = -4.98, dl = 600, p < .0001$; Cohen's $d = .51$) and behaviors of important others (LEC: $M = 3.69, SD = 3.98$; HEC: $M = 4.92, SD = 3.73; t = -3.88, dl = 600, p < .0001$; Cohen's $d = .32$), had stronger feelings of control over PEB (LEC: $M = 3.75, SD = .92$; HEC: $M = 4.17, SD = .91; t = -5.54, dl = 600, p < .0001$; Cohen's $d = .46$), and felt a stronger moral obligation to adopt such behaviors (LEC: $M = 3.64, SD = .65$; HEC: $M = 4.04, SD = .63; t = -7.48, dl = 600, p < .0001$; Cohen's $d = .62$). Students with HEC also had stronger intentions (LEC: $M = 3.63, SD = 1.07$; HEC: $M = 4.22, SD = 1.00; t = -7.01, dl = 600, p < .0001$; Cohen's $d = .57$) and reported performing more PEB (LEC: $M = 2.28, SD = .57$; HEC: $M = 2.48, SD = .56; t = -4.28, dl = 600, p < .0001$; Cohen's $d = .35$).

Furthermore, the correlation matrix presented in Table 2 indicates that the independent variables in the TPB are all significantly associated with behavioral intentions and self-reported PEB. As expected, the independent variables correlated more strongly with intentions than with behavior. Results also show that the behavioral, injunctive, descriptive, and control beliefs refer to different constructs, their intercorrelations varying from only .34 to .44 (Table 2). The same can be said about the different beliefs and their associated construct. For example, there is a correlation of .64 between injunctive beliefs and injunctive norms, which represent about 41% of explained variance. Therefore, they cannot be considered as one construct.

3.2. Testing the TPB model

The test of the standard TPB (Model 1) showed that this model accounted for 68.1% of the variance in high school students' behavioral intentions and 27.3% of the variance in their reported PEB (see Fig. 2). Relying on Cohen's (1988) guidelines, we can say that perceived control had a strong effect on intentions (standardized beta, $\beta = .446, SE = .082, p < .0001$), whereas the effect of descriptive norms was moderate ($\beta = .294, SE = .083, p < .0001$) and that of attitudes small ($\beta = .174, SE = .065, p < .001$). Injunctive norms had no significant effect on intentions ($\beta = .040, SE = .059, p = .496$). The effects of intentions ($\beta = .226, SE = .087, p < .01$) and perceived control ($\beta = .328, SE = .090, p < .0001$) on behavior were both moderate. The direct links between the belief composites and the respective direct measures were all high (β s between .729 and .824, $p < .0001$). The fit indices indicated that the standard TPB model (Model 1) provided an excellent fit to the data: CFI = .948; TLI = .934; RMSEA = .056.

In Model 2, moral norms were introduced into the standard TPB (Model 1) as an additional predictor of intentions. Results indicated that Model 2 provided an acceptable fit to the data (CFI = .914; TLI = .891; RMSEA = .069) and that it explained 70.9% of the variance in behavioral intentions (+2.8%). We did not retain moral norms for subsequent analyses for two reasons. First, the model fit

decreased from excellent to adequate and second, the explained variance in intentions increased by only 2.8%.

In sum, the original TPB model explains a large proportion of students' intentions to adopt PEB, whereas the addition of moral norms adds very little to its predictive power. Moreover, the extent to which people believe they have control over PEB seems to be of particular importance in fostering the motivation to adopt eco-friendly behaviors.

3.3. Effects of beliefs

Our results showed that the significant predictors of pro-environmental intentions were attitudes, descriptive norms, and perceived control (see Fig. 2). In this section we examine the individual beliefs (i.e., expectancy-value products) that had a significant impact on these components of the TPB.

The 12 behavioral beliefs explained 32.2% of the variance in attitudes toward performing PEB. The effects of three of these beliefs were statistically significant: "I would save energy" ($\beta = .199, SE = .063, p < .01$); "I would help keep our planet clean" ($\beta = .191, SE = .076, p < .01$); and "I would help protect our natural environment" ($\beta = .172, SE = .072, p < .05$). The behavioral beliefs regression model provided an excellent fit: CFI = .978; TLI = .949; RMSEA = .040.

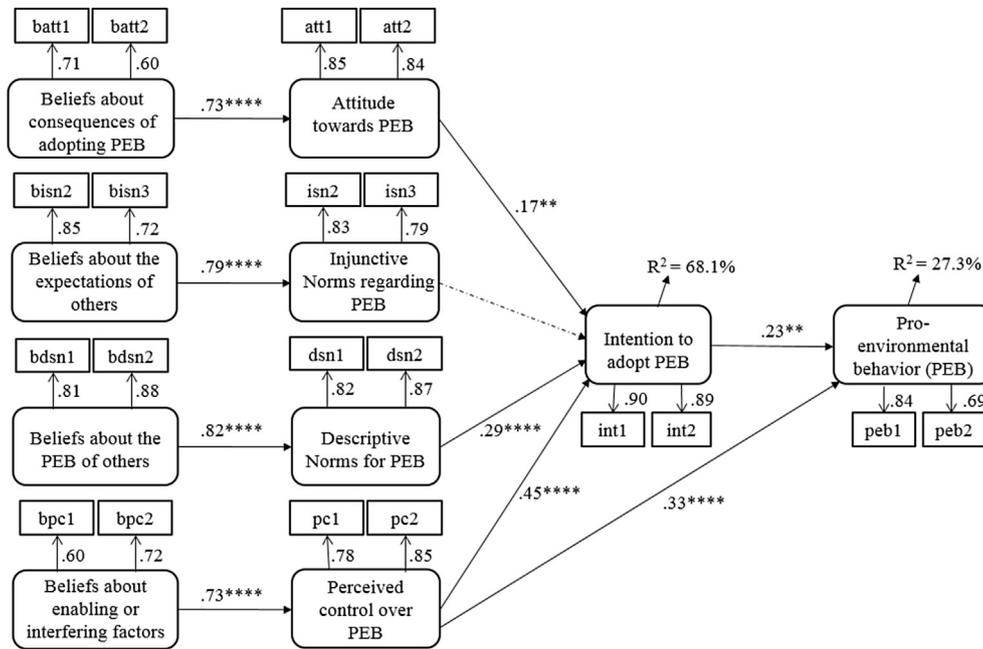
Because injunctive norms did not make a significant contribution to the prediction of intentions, we did not examine the effects of individual injunctive normative beliefs. The 9 descriptive normative beliefs explained 60.3% of the variance in descriptive norms. The effects of four of the nine descriptive normative beliefs were significant, notably the perceived behaviors of the father ($\beta = .199, SE = .061, p < .001$), the mother ($\beta = .254, SE = .067, p < .0001$), the family in general ($\beta = .240, SE = .055, p < .0001$), and to a lesser extent, celebrities who are committed to protecting the environment ($\beta = .089, SE = .039, p < .05$). The model provided excellent data fit: CFI = .981; TLI = .954; RMSEA = .054.

The model in which the 12 control beliefs predict perceived behavioral control also provided excellent data fit (CFI = .992; TLI = .981; RMSEA = .022). Control beliefs explained 27.3% of the variance in perceived control, with five beliefs having a significant effect: "If the printer I'm regularly using prints on both sides of a sheet of paper" ($\beta = .222, SE = .055, p < .0001$); "If we have recycling bins at home" ($\beta = .156, SE = .054, p < .001$); "If I can afford buying ecological products" ($\beta = .136, SE = .055, p < .01$); "If there were interesting movies, documentaries and articles about the natural environment, suitable for teenagers my age" ($\beta = .115, SE = .051, p < .05$); and "If stickers, boards and voice guides specified which behaviors to perform and how" ($\beta = .111, SE = .053, p < .05$).

3.4. Effects of sex and empathic concern

3.4.1. Direct and mediated effects

To test hypothesis 3, sex and empathic concern were introduced simultaneously into the standard TPB (Model 1) as background factors. The results are shown in Fig. 3. The model provided an excellent fit to the data (CFI = .951; TLI = .936; RMSEA = .051). Sex had neither a direct nor indirect effect (i.e., mediated through the belief composites, proximal determinants, and intentions) on reported behavior. The direct effect of empathic concern on intentions and on behavior were also not significant ($\beta = .055, SE = .033, p = .095$; $\beta = .087, SE = .048, p = .068$). However, empathic concern had a significant effect on behavioral belief composite ($\beta = .453, SE = .044, p < .0001$), descriptive normative belief composite ($\beta = .270, SE = .044, p < .0001$), injunctive normative belief composite ($\beta = .237, SE = .047, p < .0001$), and control belief composite ($\beta = .372, SE = .044, p < .0001$).



Note. To avoid overloading the figure, arrows between predictor variables and between belief-based variables are not shown. Correlations between predictor variables were: .020 between attitude and injunctive norms; .362**** between attitude and descriptive norms; .614**** between attitude and perceived control; .237** between injunctive norms and descriptive norms; .060 between injunctive norms and perceived control; and .427**** between descriptive norms and perceived control. Correlations between belief-based variables were: .713**** between belief-based attitude and belief-based injunctive norms; .613**** between belief-based attitude and belief-based descriptive norms; .790**** between belief-based attitude and belief-based perceived control; .837**** between belief-based injunctive norms and belief-based descriptive norms; .744**** between belief-based injunctive norms and belief-based perceived control; and .782**** between belief-based descriptive norms and belief-based perceived control.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

. . . = non-significant

Fig. 2. TPB variables predicting high school students' pro-environmental behaviors (PEB).

3.4.2. Moderating effect of empathic concern

SEM analysis indicated that sex had no significant impact on the TPB predictors. Consequently, no cross-sex comparison of moderating effects with respect to beliefs were performed. As for empathic concern, the SEM analysis indicated that it had a significant effect on each of the four belief composites in TPB. However, because the lowest impact was on belief-based injunctive norms, and because injunctive norms did not significantly predict intentions to perform PEB, we decided to test the moderating effect of empathic concern only on the predictive power of behavioral beliefs, descriptive normative beliefs, and control beliefs. To examine whether empathic concern moderated the association between individual beliefs and their respective constructs, we used MIMIC models. As noted earlier, this step allowed us to determine whether students with high and low empathic concern vary in terms of the beliefs that significantly predict their attitude, subjective norms, and perceptions of control.

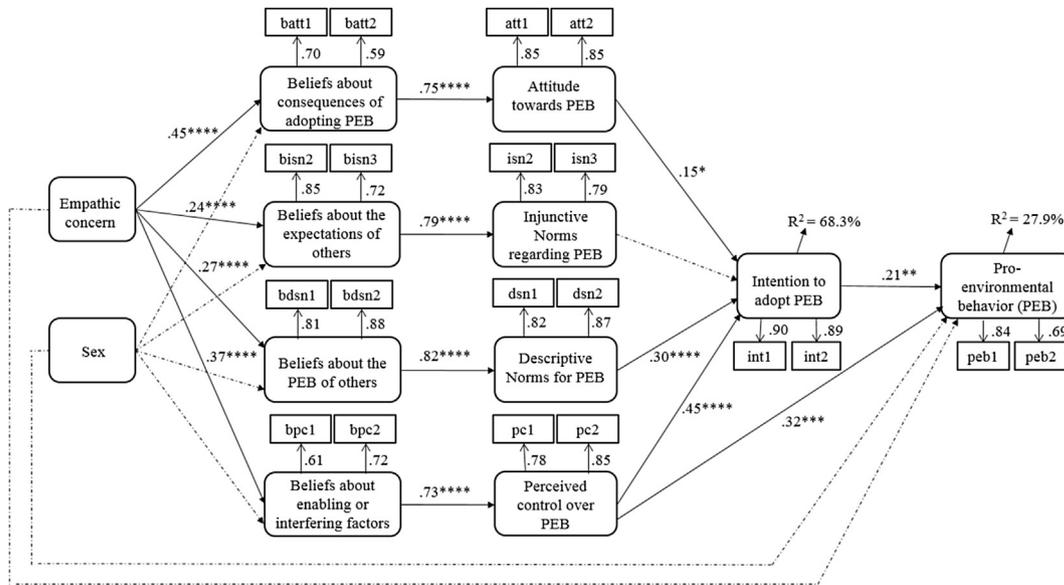
A significant difference ($\Delta CFI > -.01$) was found with respect to the behavioral belief "I would think that it makes no sense to perform these behaviors, because not enough people are behaving this way" in the prediction of attitude. This belief was significant in the HEC group only (HEC: $\beta = -.128$, $SE = .053$, $p < .01$; LEC: $\beta = .085$, $SE = .064$, $p = .186$). Similarly, a significant difference was found for the behavioral belief "I would help protect the trees" ($\Delta CFI > -.01$). However this belief was not a significant predictor of attitude in

either group (HEC: $\beta = .140$, $SE = .076$, $p = .064$; LEC: $\beta = -.130$, $SE = .076$, $p = .087$).

4. Discussion

The results of the present study confirm the utility of the TPB as a framework for understanding high school students' pro-environmental intentions and behavior. Attitudes, subjective norms, and perceived behavioral control accounted for a large proportion of the variance in intentions to engage in eco-friendly behaviors, and these intentions—together with perceived behavioral control—afforded good prediction of self-reported behavior over an extended period of time. Structural equation analyses revealed an excellent fit between the standard TPB model and the data, and although the addition of moral norms increased the proportion of explained variance in intentions, the increase was small and the model fit deteriorated. For all practical purposes, therefore, the standard TPB model proved sufficient in this application.

The strong impact in this study of perceived behavioral control on intentions and on behavior is especially noteworthy. This finding highlights the importance of creating conditions to facilitate performance of eco-friendly behaviors and of removing any potential barriers. Examination of the specific control beliefs that impacted overall perceptions of control among our high-school student



Note. To avoid overloading the figure, arrows between predictor variables and between belief-based variables are not depicted, as well as the effects of empathic concern and sex on intention. Correlations between predictor variables were: .032 between attitude and injunctive norms; .382**** between attitude and descriptive norms; .618**** between attitude and perceived control; .235** between injunctive norms and descriptive norms; .069 between injunctive norms and perceived control; and .431**** between descriptive norms and perceived control. Correlations between belief-based variables were: .704**** between belief-based attitude and belief-based injunctive norms; .584**** between belief-based attitude and belief-based descriptive norms; .755**** between belief-based attitude and belief-based perceived control; .829**** between belief-based injunctive norms and belief-based descriptive norms; .725**** between belief-based injunctive norms and belief-based perceived control; and .765**** between belief-based descriptive norms and belief-based perceived control. The effect of empathic concern on intention was $\beta = .055, SE = .033, p = .095$; the effect of sex on intention was $\beta = -.023, SE = .030, p = .439$. ** $p < .05$. *** $p < .01$. **** $p < .001$. ***** $p < .0001$. -.-.- = non-significant

Fig. 3. TPB variables predicting high school students' pro-environmental behaviors (PEB) and the effects of the background factors sex and empathic concern.

sample revealed five factors of particular importance: Availability of a duplex printer to enable printing on both sides of the paper, the presence of recycling bins at home, the affordability of eco-friendly products, the availability of ecological information suitable for adolescents, and guidelines regarding appropriate eco-friendly behaviors. These findings provide useful information for interventions designed to encourage PEB by means of increasing people's perceived (and actual) control.

Only three behavioral beliefs were found to have significant effects on attitudes toward adopting eco-friendly behaviors: beliefs concerning the ability to save energy, to keep our planet clean, and to help protect our natural environment. Together with the finding that attitudes were already quite positive, this suggests that interventions emphasizing the positive outcomes of behaving in an eco-friendly manner are less likely to be effective than interventions targeted at perceived behavioral control.

As for the role of subjective norms, descriptive norms had a significant effect on intentions to engage in eco-friendly behaviors but injunctive norms did not. This finding demonstrates that among adolescents, what others do to protect the environment is more important than what they say. Of particular importance was the behavior of the parents, the family in general, and to some extent celebrities. For a norm-based intervention to be effective, therefore, it should focus on the behavior of important others,

perhaps by encouraging parents and other family members to set good examples.

Compared to boys, girls in our high-school student sample had slightly more favorable attitudes and intentions with respect to adopting eco-friendly behaviors, but they did not differ in their reported behavior. Moreover, we found no significant differences when sex was entered into the model of the TPB. Another background factor, empathic concern, also had no direct effects on intentions or self-reported behavior, but it was found to influence intentions and behavior indirectly by its significant effects on behavioral, normative, and control beliefs. This demonstrates that individual differences in terms of empathy for others can influence the beliefs people form in relation to environmental protection and can, in this way, have an impact on intentions and behavior. Moreover, compared to participants low in empathic concern, those high on this variable responded more favorably on all TPB measures. These finding can help us better understand the origins of beliefs and attitudes relevant to environmental protection. They suggest that intervention efforts might be most effective if directed at students with relatively low empathic concern.

A potential limitation of this study is its reliance on self-reports of eco-friendly behaviors and the possibility that participants may have over-estimated the extent to which they performed these socially desirable behaviors. Of course, it would have been virtually

impossible to obtain objective measures for the wide variety of behaviors we tried to assess, and in any case, the present study is comparable in this regard to most other studies of pro-environmental behavior. Our assurance to participants that their responses were anonymous was designed to mitigate the tendency toward social desirability responding.

A second limitation concerns the two-step strategy used to identify key beliefs significantly related to PEB. In the first step, we performed a structural equation modeling analysis to test the full TPB model to identify significant predictors of pro-environmental intentions and behavior. This model included the belief composites (i.e. reflective indicators) in the TPB model rather than the individual beliefs (formative indicators) because our sample size was too small to test a model with a large number of variables (i.e. 40 individual beliefs). In a second step, we thus used a MIMIC model to explore which specific individual beliefs contributed to the prediction of PEB through their impact on of their respective construct, that is, attitude, injunctive norms, descriptive norms, and perceived behavioral control. However, using this two-steps strategy can increase the familywise error rate. Accordingly, it is recommended that future studies incorporate the individual beliefs to test the full TPB model rather than proceed in two steps as we did in the current study. However, this recommendation of testing the full TPB model with the individual beliefs will not be easy to apply considering the large sample size of participants required.

Although consistent with findings in other behavioral domains, a third limitation is that the TPB model predicted only 29.9% of PEB. This may be attributable in part to issues related to the validity of our PEB measure. The sample of pro-environmental behaviors used in the study was not perfectly representative of all possible PEB. What's more, events that occurred between assessment of intention during the initial trimester and assessment of PEB during the final trimester may have produced changes in intentions and unanticipated obstacles may have prevented the students from carrying out their intentions (Ajzen, 2014). Thus, even though the gist of our results seems to be that students emphasize tools that would facilitate PEB (i.e., having printers that print on both sides of a sheet of paper, recycling bins at home, interesting movies, documentaries and articles about the natural environment suitable for teenager, stickers, boards and voice guides specified which behaviors to perform and how), researchers should be aware in future research that such factors by themselves may be insufficient to motivate young people to adopt PEB. In fact, the control beliefs that are accessible in the real situation in which an eco-friendly behavior is performed can differ from the control beliefs that are accessible in the hypothetical situation in which the TPB constructs are typically assessed (Ajzen, 2012; Ajzen & Sexton, 1999). For instance, it is possible that there is a discrepancy between young people's real self-regulation skills (e.g. having the necessary discipline to recycle paper) and their perceived ones. Thus, the present results suggest that interventions to facilitate the adoption of PEB among young people should target such control beliefs, but that the behavioral and normative beliefs should not be neglected.

Future research can rely on the key beliefs identified in the current study to develop sound educational interventions that aim to foster PEB among young people. Our data showed that many high school students who had positive PEB intentions failed to act on them. In this case, to design an effective behavior change intervention, investigators must (i) try to make sure that the beliefs accessible in the behavioral context do not differ substantially from the accessible beliefs that were identified in the elicitation phase; (ii) that participants have the means, skills and other resources to perform the behavior of interest; (iii) that all potential barriers to its performance have been removed; and (iv) that no unanticipated events or new information have led to revised intentions after the

intervention has taken place (see Ajzen, 2014). Only when all of the above preconditions are met can we confidently expect that changes in beliefs will tend to produce a positive change in PEB among young people.

On the positive side of the ledger, the present study made a number of important contributions to our understanding of PEB. First, it is one of the few studies to employ the full framework provided by the TPB, including not only direct measures of attitude, subjective norm, and perceived behavioral control as predictors of intention and self-reported behavior but also accessible behavioral, normative, and control beliefs that are assumed to underlie these predictors. Second, this is one of the few TPB studies to separately assess injunctive and descriptive norms as well as injunctive and descriptive normative beliefs. Third, unlike the frequent cross-sectional studies in this domain that stop at intentions (or, at most, assess prior behavior), our study took a longitudinal approach to predict future behavior. Fourth, the participants in our study were high-school students, arguably an important population because eco-friendly habits may be established early in life and because high-school students are often exposed to environmental education as part of their curriculum. In this regards, finally, our discussion above shows how the results of the present study can provide useful guidance regarding the kinds of factors to be considered in designing an effective behavior change intervention.

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