Open access • Journal Article • DOI:10.1080/09500693.2010.540725

The Effect of Flemish Eco-Schools on Student Environmental Knowledge, Attitudes, and Affect — Source link

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Published on: 15 Mar 2011 - International Journal of Science Education (Routledge)

Topics: Environmental education, Knowledge level and Affect (psychology)

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Journal:	*International Journal of Science Education*
Manuscript ID:	TSED-2010-0284-A.R1
Manuscript Type:	Research Paper
Keywords :	eco-schools, effectiveness
Keywords (user):	

THE EFFECT OF FLEMISH ECO-SCHOOLS ON STUDENT ENVIRONMENTAL KNOWLEDGE, ATTITUDES AND AFFECT

Abstract

Eco-schools aim to improve the environment through direct and indirect effects. Direct effects are those that result from the implementation of an environmental management system. Indirect effects are educational gains. The current study examines the effectiveness of eco-schools concerning three student outcomes: (1) environmental knowledge (2) environmental attitudes and (3) environmental affect. The study includes 1287 10-12 year olds from 59 schools (38 eco-schools and 21 control schools). Multivariate multilevel regression analyses show that eco-schools mainly influence their students' environmental knowledge; they do not influence environmental affect. Eco-school students furthermore have equal preservation attitudes, and lower utilization attitudes, as compared to control-school students. The implications of these results for research and practice are discussed.

Keywords

Eco-schools; environmental knowledge; environmental attitudes; environmental affect; multivariate multilevel regression analysis.

Introduction

Since the Industrial Revolution, human activities have led to the disruption of ecosystems to an extent that is increasing exponentially. The destruction of habitats, the introduction of invasive exotic species, ever increasing pollution and over-exploitation have all lead to a degradation of the natural world that has far-reaching consequences, both for mankind and for nature (Diaz, Fargione, Chapin & Tilman, 2006). The way humanity is mistreating the earth and its natural riches in a single lifetime will impoverish our descendants for all time (Wilson, 1993). Examples are well known (loss of biodiversity, natural disasters…) and have come to occupy a prominent place, both in current affairs and in the media. An important way of raising awareness is the establishment of environmental education initiatives (or EEIs) (UNESCO, 1978; United Nations, 2005), which intend to change the way we interact with the natural environment. This is particularly important for young people, because they will ultimately be affected by, and need to provide, solutions for environmental problems arising from present-day actions. Being the future scientists, policymakers, consumers and voters, today's youth will be responsible for bettering the environment, and they will be the ones who must be persuaded to adopt and pay the costs of future environmental policies. Therefore, it appears that effective environmental education for school-age students is crucial. Eco-schools are schools that have engaged in a programme that means to (1) better the environment directly, through the adoption of an environmental management system, and (2) do so indirectly, by changing the way students perceive and interact with the natural world. The current study examines the effect of eco-schools on three student outcomes: environmental knowledge, attitudes and affect.

Eco-schools

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The Eco-schools International Programme operates within the framework of the Foundation for Environmental Education, a non-governmental organisation bringing together national non-governmental organisations and implementing programmes for environmental education, management and certification. The main principle of the programme is that eco-thinking should become a way of life. In this way, future consumers, manufacturers and those involved in decision-making become more sensitive to the environment. The project is based on:

- the principles of interdisciplinarity (combining natural sciences and social subjects to fully understand all aspects of a particular issue)
- a comprehensive and systematic approach (considering the complexity of environmental problems)
- activities (orientated towards the future, finding and defending different ideas, taking into account the needs of future generations)
- connecting real local environmental problems and global environmental issues, and playing an active role in democratic decision-making on environmental issues by combining cognitive emotional and aesthetic aspects.

Currently, the programme is being implemented in 47 countries around the world, involving 32,156 schools (9,898 of which have already been certificated), 9,125,460 students, 628,005 teachers and 5,013 local authorities (Foundation for Environmental Education, 2010).

In 2005, Mogensen and Mayer published a large-scale qualitative research report on the development process of eco-schools in 13 countries. All eco-school programmes that participated in the Morgensen & Mayer study were asked for documentation and a report on the results achieved. Countries differ in the kind of results and reports produced. Almost always the report is made up of a list of victories and successes, and not as a reflection on the hurdles that were faced and the solutions found (or not, as the case may be) to deal with them. Based on these country reports, Morgensen & Mayer (2005, p.86) conclude that '*It is too easy*

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to degenerate into an activism devoid of content, and to join the programme for the prestige it brings, not because the schools truly believe in what they are doing'. Furthermore, the risk is that the eco-schools programmes might consider only the technical results that are as measurable, and thus assessable, and that the eco-school programme is therefore limited to a '*…mere physical improvement in the school environment, lacking the perception of its educational effects'* (Morgensen & Mayer, 2005, p.86). An increase in the environmental performance of schools due to their participation in the programme has been demonstrated, with an increase in terms of performance with regard to water, waste, energy and greening-related aspects due to the implementation of environmental management systems (Hens *et al.*, 2010), but the extent to which eco-schools also achieve an educational gain (i.e. an increase in knowledge, attitudes, affect) in their students remains a topic that has not received the necessary attention.

Environmental knowledge, attitudes and affect

In the area of environmental education research, many researchers have used the three-component attitude model as an approach for specifying the structure of environmental attitudes (e.g. Leeming, Dwyer & Bracken, 1998). In this approach, environmental attitudes have a cognitive, an affective and a behavioural component. However, contemporary theorists tend to hold that cognition, affect and behaviour are, in fact, the bases on which the general evaluative summary of a particular psychological object is derived, instead of being the constituents of attitudes (Fabrigar, MacDonald & Wegener, 2005). It has, for instance, been argued that "*…affect, beliefs, and behaviours are seen as interacting with attitudes rather than being their parts*" (Albarracin *et al.*, 2005, p.5). Therefore, even though the three component model remains the traditional view of attitude structure, new theoretical

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approaches prefer to conceptualise attitudes as evaluative tendencies that can be both inferred from, and have an influence on, knowledge, affect and behaviour.

The oldest and simplest models explaining the interconnectedness between environmental attitudes and behaviours were based on a linear progression from knowledge to attitudes, which led, in turn, to pro-environmental behaviour. These models were soon proven to be too simplistic, although they are still present in common wisdom. More elaborate and complex models include other factors that influence behaviour; e.g. the theory of reasoned action (Fishbein & Azjen, 1975), which is grounded in self-interest-based and rational-choice-based deliberation. This is why individuals drive cars, for example, although they are aware of the impact on climate change. Recently, Van Petegem, Blieck and Van Ongevalle (2007) described a new perspective on this complex relationship, in which environmental attitudes influence behaviour indirectly. Specific variables, costs and social relations need to be taken into account as they interact with attitudes and beliefs. Hines' model, based on behavioural change, also focuses on additional conditions, including personality factors, knowledge of issues, and possession of skills in terms of taking action (Hines, Hungerford & Tomera, 1986/87). All these interact in an intention to act, but the ultimate behaviour is triggered by situational factors. Psychological and sociological models use different internal and external factors. Internal factors include motivation, knowledge, values, attitudes, emotional involvement and locus of control. External factors are represented by institutional, social and cultural factors. As external factors can change or even be evaded, internalised pro-environmental behaviour (Stern, Dietz & Guagnano, 1995) is supported by internal factors.

It has been about 20 years since the appearance of more complex models of change in environmental behaviour that challenged the simple linear model of knowledge through attitudes to behaviour change. The perception is, however, still common among many educators that telling someone to behave in a certain way and also giving a reasonable and

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understandable explanation, will cause a change in his or her behaviour – in other words that teaching behaviour is possible (Krnel & Naglic, 2009). Courtenay-Hall and Rogers (2002) argue that shaping human behaviour as a fundamental aim of environmental education is in contradiction with at least the 50 last years of debate on educational goals. Such a behaviouristic approach is bypassing students as thinking beings, capable of making their own decisions about what constitutes responsible environmental behaviour. An educational approach that targets the internal factors (such as environmental knowledge, and environmental attitudes) that relate to environmental behaviour could therefore be key to achieving internalised responsible environmental behaviour. The influence of knowledge on behaviour is complex. While researchers agree that knowledge alone will not motivate someone to adopt a new behaviour (Schultz, 2002; Stern, 2000), it is equally clear that a lack of knowledge can be a barrier to changing behaviour (Schultz, 2002; DeYoung, 2000). Different types of knowledge can be distinguished. Procedural knowledge (how to conduct the behaviour) is worth conveying, since a lack of it could be an impediment. Similarly, impact knowledge (that describes the added value of a behaviour in achieving an environmental target) is also a valuable form of feedback. Some models include a broad background in environmental knowledge; this type of knowledge doesn't appear to separate those who engage in environmental behaviours from those who don't. Rather than directly determining behaviour, this general environmental knowledge might be instrumental in forming the values and attitudes that underlie behaviour.

Much of the research on environmental attitudes and knowledge focuses on the role of socio-demographics in explaining differences between individuals' environmental attitudes. Gender has received much attention in this field of research. Scholars generally agree that while girls are more concerned about the environment than males (Zelezny, Chua & Aldrich, 2000), they know less about environmental topics and issues (e.g. Coertjens *et al.*, 2010). There are

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inconsistencies in the literature though, as some researchers have found no differences between the sexes (e.g. Evans *et al.*, 2007), while others (e.g. Oerke & Bogner, 2010) have found the genders to differ in specific environmental attitudes. A widely used approach to explain gender differences in environmentalism is based on gender roles and socialisation (Zelezny *et al.*, 2000). Socialization theory posits that individuals are shaped by gender expectations within the context of cultural norms. Females across cultures are socialized to be more expressive, to have a stronger ethic of care, and to be more interdependent, compassionate, nurturing, cooperative and helpful in care-giving roles. Males, on the other hand, are socialized to be more independent and competitive (Eagly, 1987). These differences in socialization between the sexes could then be reflected in environmental attitudes. Researchers have demonstrated that younger people tend to hold more positive attitudes than older people. In some of the literature, age appears as the strongest correlate to environmental attitudes (Arcury *et al.*, 1987). Young people are believed to be less integrated into society than are adults, and will thus more readily criticize industrial and governmental policies. Another focal point in the research on environmental attitudes is the influence of social background or socioeconomic status. Generally, research has illustrated that individuals with higher income levels are associated with knowing more about the environment (e.g. Coertjens *et al.*, 2010) and holding more positive environmental attitudes (e.g. Ozgul, Boone & Andersen, 2004; Shen & Saijo, 2007). Herera (1992) argues that people with higher income levels are more accustomed to living in healthy environments and that they therefore have beliefs that support environmental protection. The relationship between income and environmental knowledge could also be attributed to the higher educational levels that wealthier people typically achieve. Furthermore, several studies have found that higher levels of education have a positive effect on environmental attitudes (Barr, 2007; Van Liere & Dunlap, 1980). The general explanation is that during their education, people get exposed to a

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broad variety of beliefs and ideas, thus encouraging a liberal-minded perspective on life. Most of the results discussed above focussed on adults; Boeve-de Pauw and Van Petegem (2010), illustrated that the social background explains variation in the environmental attitudes of children as well: children with a more advantaged economic background hold less pro-environmental attitudes; on the other hand children from families with a high cultural capital hold more pro-environmental attitudes. Several studies have shown that residence in an urban area is generally associated with greater environmentalism (e.g. Buttel, 1992). Urban dwellers are more exposed to environmental problems at first hand, and will therefore develop more pro-environmental attitudes (Tremblay & Dunlap, 1978). Alternatively, the difference in environmental attitudes between urban and rural residents has been assigned to historical-cultural differences: rural residents have a tradition of using the natural environment as a source of income and are therefore more tended to see nature as a resource than as a common good with an intrinsic value (e.g. Bogner & Wiseman, 1997; Leftridge & James, 1980).

Traditional measures for environmental attitudes have used a psychometric approach that - while multiple dimensions might be included in the instrument - applies a uni-dimensional, higher order structure. Recently Wiseman and Bogner (2003) developed an approach that has a bi-dimensional higher order structure; in this approach, environmental attitudes are hierarchically organised within two major attitude groups, or values: Preservation and Utilization. The first is an ecocentric dimension that reflects conservation and protection of the environment. The second is an anthropocentric dimension that reflects the utilization of natural resources. Milfont and Duckitt (2004) confirmed the bi-dimensional approach, and furthermore showed that preservation attitudes are linked to (self-reported) pro-environmental behaviour, while utilization values are not. This bipartition provides a more nuanced look at the classically assumed link between environmental behaviour and (uni-dimensional measures of) environmental attitudes or values. A bi-dimensional model also seems consistent with the

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contemporary Sustainable Development (SD) debate (see Schmuck & Schultz, 2002; Schmuck & Vlek, 2003), as it does not impose a rejection of one persuasion when one accepts another, but rather allows for an integrated set of attitudes that can be (but doesn't have to be) in favour of both the preservation and utilisation of natural resources.

The main part of the literature on the effect of EEI reports on knowledge and attitudes. The importance of affect in the context of human relationships with the natural environment has been proposed by several scholars (Kaplan & Kaplan, 1989; Kals & Maes, 2002). Empirical research has found that engendering greater empathy towards nature tends to increase the level of connectedness people feel towards it (Schultz, 2000). Such empirical data support Wilson's (1984) biophillia hypothesis, which suggests that, as a species, humans have an intrinsic affiliation with the natural world. Wilson posited that the natural world continues to influence the human condition through our previous close and enduring evolutionary relationship with it. Essentially, the argument is that our technological development has been so rapid that our evolutionary adaptation to modern environments hasn't yet followed, and needs to develop substantially. Therefore, according to Wilson (1993), there is still a need to relate to nature: we have an "… innately emotional affiliation… to other organisms" (p.31). There are, however, some advocates of the biophilia hypothesis who have suggested the bond may well be a weak one, requiring the addition of culture, learning, and experience of nature to optimise biophilic tendencies (Kellert, 2002). Therefore it is an interesting approach to also include – next to knowledge and attitudes – environmental affect into the envisioned outcomes of EEI and eco-schools.

Eco-schools and the effect of environmental education interventions

Based on the PISA 2006 data, Coertjens *et al.* (2010) demonstrated that students who attend schools that organise environmental learning activities, display more pro-enviromental

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attitudes. The design of the study did, however, not allow the researcher to assign the effect to the schools' participation in the eco-school programme, as 'environmental learning activities' could mean different things to different schools. There is evidence that short term interventions can have educational gains. Randler, Ilg and Kern (2005) demonstrated that 9-11 year olds that took part in a conservation programme in which they encountered living animals, showed an increase in their knowledge on the subject of the programme, but not in their attitudes towards the animals they had encountered. Johnson and Manoli (2008) showed that children participating in an earth education programme (as compared to a control group) displayed an increase in their environmental attitudes. Duerden and Witt (2010) distinguished direct from indirect (learning) experiences with nature. Their findings indicated that environmental knowledge increased more than environmental attitudes during the indirect portion of their intervention and environmental education programme (i.e. a preparatory part), while the direct portion (an international workshop) produced similar levels of knowledge and attitude growth. In 2006, Smit *et al.* published a report on the effects of environmental education (EE) in Dutch primary schools. The authors contacted adults by telephone and interviewed them about environmental education in the school they attended when they were children. The study shows that more EE in school results in adults who are more knowledgeable about the environment and who display more pro-environmental attitudes. Krnel and Naglic (2009) performed a study on the differences in environmental literacy between ordinary and eco-schools in Slovenia. They illustrate that though the goal of Slovenian eco-schools is to increase knowledge as well as pro-environmental attitudes and behaviour, the effect lies in the cognitive field: students from eco-schools were shown to be more knowledgeable about environmental topics and issues, but this enhanced knowledge was not reflected in more pro-environmental attitudes.

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Research Goal

The present study aims to examine the effectiveness of eco-schools in terms of their intended goals. While controlling for differences between pupils (gender, socio-economic status, home language), the following research question was central to the study: do pupils enrolled in eco-school know more about nature and the environment, do they hold more pro-environmental attitudes, and display a greater environmental affect than pupils enrolled in non-eco-schools?

Most school effectiveness studies take the schools' input characteristics and context into account in assessing the influence of process factors at the school or classroom level on output measures. Student achievement in the basic disciplines like mathematics and mother tongue are frequently used as output measures (Scheerens & Bosker, 1997). Davies (1997) emphasized, however, that the choice of output criteria does not play a neutral role, and that an excessively narrow operational definition of school effectiveness indicates an overly restricted vision on the goals of education. Given this criticism, some scholars have stressed that SE research should focus on a multitude of output measures (Reynolds & Teddlie, 1999). This includes a plea for broadening the research from solely achievement measures in mathematics and language, toward attitudes, as goals of the socializing function of the school (De Maeyer *et al.*, 2010). In this study, we focus on environmental knowledge, as well as on environmental attitudes and affect.

Methods

Sample

In total, 1287 pupils from 59 schools participated in the study; all were in the last year of primary education. The respondents' age ranged from 10 to 12, with a mean age of 11.23 ± 0.55; the sex ratio (boys:girls) was 0.49 with 652 girls and 626 boys (and 9 unknown). In

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total, 90 schools were asked to participate in the study: 45 eco-schools and 45 non-eco-schools. To control for regional differences in the sample, schools were selected based on their location. For every eco-school in the sample, a non-eco-school was selected in its vicinity (see Figure 1). The overall response-rate for schools was 66%, with an eco-school response-rate of 86%, and a non-eco-schools response-rate of 46%. 779 pupils attended one of the 39 eco-schools in the sample, and 508 pupils one of the 21 non-eco-schools schools. In each school, a single final year class was asked to participate; thus, all pupils within a school came from the same class. Classes have a mean size of 19.75 ± 7.61 pupils. There were no differences in age or sex composition between the eco-schools and the control schools. 13.9% of the respondents used another language at home other than the language of instruction at school (i.e. Dutch).

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At the moment of the data collection, the eco-school project in Flanders had been up and running for 10 years. Eco-schools are accredited with three successive logos by an external jury (Sleurs, 2005). The eco-schools in our sample are among those that obtained their first eco-logo back in 2003, and their third logo in 2005. These were the first schools in Flanders to obtain an eco-school logo. Given that (1) Flemish primary education lasts six years, (2) the eco-schools in our sample obtained their first logo six years prior to the data collection, and (3) the pupils in our sample are in their last year of primary education, they had all been exposed to the eco-school project for their entire education in that school, and to the three logo state for the last four years. In Flanders, 72% of primary schools are involved in the eco-schools project at some stage (Department of Land, Nature and Energy, 2010). Those schools that aren't involved can be considered as valuing environmental education as being of low priority in terms of school policy.

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Before administering the questionnaires to the respondents, we ran a pilot study for item comprehensibility, difficulty and interpretation with a small group of 30 children. Based on the preliminary results, some items were replaced or reworded.

Measures

Outcomes variables. Three major outcomes of the eco-school programme are included in the study: environmental knowledge, environmental attitudes, and environmental affect.

Environmental knowledge (KNOW) is measured using items from the Children's Environmental Attitudes and Knowledge Scale (CHEAKS) (Leeming, Dwyer & Bracken, 1995). The original test included 30 multiple-choice questions, varying in focus across six topics: pollution, recycling, animals/biodiversity, energy, water and general. Leeming *et al.* (1995) report a Cronbach's alpha of 0.65 for the cognitive test of the CHEAKS. A pilot study resulted in an updated version of the test, consisting of 18 items: 12 original (two for each topic) and 6 new ones (one for each topic). The 12 original CHEAKS items were selected based on previous research with older respondents (aged 16-18); these were the 2 items for each of the six topics with regard to which these older youths showed the highest percentage of correct answers. All eighteen items were pre-tested for item interpretation and wording difficulties with a small group of eight children aged 10-12 (who were not included in the data collection for the present study). No problems were reported. For each item, five possible answers were provided from which the respondent chose one. Further analysis showed that eleven items were of an acceptable level of difficulty (0.2< p <0.8). These eleven items were used in further analyses. A sample question for the topic 'water' is "Building a dam on a river can be harmful because it: (a) makes the river muddy (b) can no longer be used to make electricity (c) increases the level of pollution in the water (d) causes the river to flood (e) damages the river's natural ecosystem".

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The pupils' environmental attitudes are measured using Bogner & Wiseman's (2006) two dimensional model of ecological values (or 2-MEV). This model for assessing environmental attitudes consists of two higher order factors (or orthogonal dimensions): Preservation (PRES) and Utilization (UTIL). Both are measured by ten items on a five point Likert scale (ranging from 'strongly disagree' to 'strongly agree', with a neutral 'neither agree nor disagree' in the middle). A sample item for the Preservation factor of environmental attitudes is "We must set aside areas to protect endangered species". A sample item for the Utilization factor of environmental attitudes is "We need to clear forests in order to grow crops". Bogner and Wiseman (1997) report alphas of 0.84 for P and 0.81 for U. These alphas were based on another set of items than the ones that were used in the present study (taken from Bogner & Wiseman, 2006), to measure to same construct. To our knowledge, more recent studies using the 2-MEV do not report its internal consistency.

Third, we assessed the children's affection (AFF) for the environment, as measured by Leeming *et al.*'s (1995) CHEAKS. The scale taps the concept with regard to twelve items, using a five-point Likert scale (ranging from 'strongly disagree' to 'strongly agree', with a neutral 'agree nor disagree' in the middle). A sample item is "It makes me sad to see houses being built where animals used to live". Leeming *et al.* (1995) report Cronbach's alphas ranging from 0.85 to 0.89 for an instrument that included these items on environmental affect, together with items on environmental behaviour and behavioural intention.

Explanatory variables. The pupils' socio-economic status was measured based on items taken from the Organisation for Economic Cooperation and Development (OECD)'s Programme for International Student Assessment (PISA). The PISA index for economic, social and cultural status (ESCS), is an index created to capture wider aspects of family and home background. It is a composite variable consisting of the following (sub)variables: economic capital or

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possessions (WEALTH), cultural capital or possessions (CULTPOS) and home educational resources (HEDRES) of the pupils' family. We refer to the standardized indices as zESCS, zWEALTH, zCULTPOS, zHEDRES. To assess the effect of gender on the outcomes measures, we constructed a dummy variable singling out the boys in the analyses: dBOY (1=boy, 0=girl). We further included the pupils' ages (zAGE) and the language spoken at home (dLANGUAGE; 1=dutch, 0=another language). No differences in any of these explanatory variables were observed between the eco-schools and the control schools (all p>0.05).

While all of the above-mentioned explanatory variable are individual-level variables – they are included to explain/control for variance between individual respondents – the dummy variable that was created to contrast the eco-schools with the control schools (dECOSCHOOL: 1=eco-school, 0=control school), is included to explain variance at school level.

Analyses

The analyses for this study were performed in several steps. First we tested the dimensionality of outcome measures. For environmental knowledge and environmental affect we applied an exploratory factor analysis with an oblique rotation, a technique that allow for the factors that result from the analysis to be interrelated. Given the theoretically assumed two-dimensional structure of the children's environmental attitudes (2-MEV), we opted for a confirmatory factor analysis. We also tested the theoretically assumed independence of the different attitude factors by estimating the correlation between them.

Then, the effects of the explanatory variables on the outcome variables were assessed in a hierarchical linear model (HLM). We applied a multilevel analysis to examine which part of

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the variance of the outcome variables can be attributed to individual-level or to school-level characteristics. We performed the analysis in several steps. First we calculated the correlations between the four outcome variables. Based on these results, the outcome variables were combined in a multivariate design. Then we estimated a number of consecutive models, starting with a zero model (model 0, or an empty model with no explanatory variables). The purpose of the zero model was to determine the amount of variance at both levels. The zero model also allowed us to estimate the Intraclass Correlation Coefficient (ICC), which gives the proportion of the total variance that exists among groups. A low value indicates that there is little variety among groups (thus between individuals or between schools). Next, the explanatory variables were systematically included in several consecutive models. First, a model with all (and only) individual level variables was estimated. We specifically opted for the random intercept model; our main focus is not on comparing the effect of the explanatory variables between individual schools, and underpins the use of the random intercept model. Then, the individual level variables were supplemented with the school-level variable dECOSCHOOL. Again, we opted for the random intercept model. We reported the deviance of each model, indicating how well the model fits the data, and the number of estimated parameters. The use of the maximum likelihood estimation method, allowed us to use the deviances to test whether a more advanced model fits significantly better to the data than a previous model (that is nested within the more advanced model). The difference between deviances approximated a chi-square with degrees of freedom as the difference in the number of parameters of both models (Hox, 2002). Regression coefficients have to be at least 1.96 times larger then their standard error to be considered significant (Hox, 2002). The HLMs were estimated using the MLWIN 2.10 (Rasbach *et al.*, 2009) software, the confirmatory factor analysis was performed in AMOS 18.0, and all other statistics were performed using PASW Statistics (SPSS) 18.0.

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Results

Outcome variables dimensionality and characteristics

First we report the results of the analyses on the dimensionality and internal consistency for environmental knowledge and environmental affect. Next, we focus on those for the respondents' environment attitudes.

For each variable, all items were entered (for knowledge 11 items; for affect 12 items) into an exploratory factor analysis (EFA) with oblique rotation. For knowledge, the EFA initially resulted in a four factors solution. The factors explained 7.5%, 2.4%, 1.9%, and 1.2% respectively, and all had eigenvalues just above 1. Each factor contained two or three items of the eleven items included in the EFA. We opted for a uni-dimensional solution that explained more variance (18%), and showed an eigenvalue of 1.9. All eleven items relate to this factor. The response values for the eleven items were corrected for their factor loading, summated, and standardized into zKNOW. The eleven items included in zKNOW show a Cronbach's alpha of .66, indicating acceptable internal consistency.

The initial factor solution for environmental affect suggested two factors, explaining respectively 39.9% and 12.7% of the overall variance, and with eigenvalues of 4.78 and 1.52. Nine items related to the first factor, two to the second factor and one related equally to both factors. We removed the item that loaded on both factors. The two remaining items in the second factor weren't sufficient to define a new construct, and were therefore also omitted from the analysis. A rerun of the EFA without these three items, resulted in a one-factor solution, with an eigenvalue of 4.20, explaining 44.25% of the overall variance. The response values for the nine items included in this factor solution were corrected for their factor

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loading, summated and standardized into zAFF. The nine items included in zAFF show a Cronbach's alpha of 0.87, indicating high internal consistency.

To test the two-dimensional structure of the 2-MEV, we performed a confirmatory factor analysis (CFA), that explicitly fitted the Bogner & Wismeman (2006) model to our data. All twenty items (ten for each scale) were inserted into the analysis simultaneously. All twenty items loaded significantly on their respective dimensions, except for item P4 of the preservation dimension. As this item is worded rather ambiguously: "Society will continue to solve even the biggest environmental problems", it might belong to either of the dimensions, depending on the respondents' interpretation. The item was omitted and the model was refitted, and showed a Chi^2 of 376.8 with 151 degrees of freedom (Chi^2/df = 2.49). A Chi^2/df ratio in the range of 2–3 is viewed as indicating an acceptable fit (Carmines & McIver, 1981). Good fit was also viewed as indicated by RMSEA, GFI and CFI respectively, having values close to .06, .95 and .95 or better (Hu & Bentler, 1999). The final model showed a good fit to the data, with fit index values for RMSEA=0.047, CFI=0.95, GFI=0.96. The correlation between the two dimensions was significant, but very low (r =-0.036, p<0.001). This segregation provides extra support for the independence of utilization and preservation attitudes. Based on the results of the CFA, zPRES and zUTIL were calculated as the standardized sum, corrected for the regression weights, of the values on each of the preservation and utilization items respectively. The attitudinal scales showed acceptable internal consistency, with a Cronbach's alpha of 0.69 for utilization and 0.71 for preservation.

Table 1 shows for each of the outcome variables, the number of items, the scale's Cronbach's alpha, and the correlations among the different outcome variables. The outcome variables show a correlation pattern of two by two: on the one hand UTIL and KNOW are negatively correlated (r=-0.53, p<0.001), on the other PRES and AFF are positively correlated (r=0.67, p<0.001). All other correlation are, though significant (all p<0.001), small (all $r \leq 0.17$).

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Multivariate multilevel regression analyses

Given the observed correlation pattern (see Table 1) of the outcome variables, we opted for two separate, multivariate, multilevel regression analyses. The first one models zUTIL and zKNOW simultaneously as response variables (see Table 2), while the second one models zPRES and zAFF (see Table 3).

<< insert Table 2 about here >>

The zero model (model 0) in Table 2 shows that the respondents' utilitarian attitudes differed between schools. Schools accounted for 10% of the variation between students in terms of their zUTIL scores. For zKNOW, this proportion amounted to 13.5%. Model 1 shows that boys held attitudes that are more utilitarian than girls, and also showed that boys score higher in terms of environmental knowledge. The children's age was unrelated to the response variables. There is an effect of ESCS: an increase of 1 standard deviation on ESCS results in a score of 0.056 standard deviation higher in terms of environmental knowledge. The effect of ESCS on zUTIL is negative: an increase of 1 standard deviation results in a score of 0.035 standard deviation lower score on zUTIL. This result is in contrast with the existing literature in which ESCS is a major explanatory aspect of both cognitive variables and EA. Therefore we also split the ESCS variables into its components: zWEALTH, zCULTPOS and zHEDRES, and ran the analysis as shown in model 2. The results revealed that the low effects of zESCS on zKNOW and zUTIL are due to the fact that the sub-variables of ESCS have different effects. The results do show a positive effect of zHEDRES on zKNOW (β=0.104), and a negative effect of zCULTPOS on zUTIL (β=-0.103). The other sub-variables have no effect on zKNOW, nor on zUTIL. The absence of effects of most of the sub-variables resulted

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in the overall small ESCS effect. The results also showed a positive effect with regard to speaking the same language at home as the language of instruction in school in terms of environmental knowledge (β=0.295) and a negative effect on utilization attitudes (respectively β=-0.436). At the school level, the dummy discriminating eco-schools from non-ecoschools (dECOSCHOOL) was included for both response variables, since students showed a difference between schools in their scores on both variables. Children attending eco-schools scored higher in terms of zKNOW scores (β=0.185) than did children attending non-eco-schools. This difference is supplemented with eco-school-children scoring lower on zUTIL (β=-.0308). Each consecutive model estimated for zUTIL and zKNOW fitted better to the data than the previous one. The final model shows that after control for dECOSCHOOL, schools still differed, both in their students' utilization attitudes and in their environmental knowledge.

<< insert Table 3 about here >>

Table 3 reports on the multivariate HLM in which zPRES and zAFF were examined simultaneously as response variables. The zero model in Table 3 shows that a multilevel approach is necessary. While the variance in zPRES is explained solely by the level of the individual respondents, the variance in zAFF can be assigned to both levels, with the individuals accounting for 96% and the schools for 4%. The covariance between zPRES and zAFF is significant, illustrating that a multivariate approach is necessary. The consecutive models in Table 3 were estimated to assess the effect of the individual-level explanatory variables and the school-level variable. Again, model 1 includes only individual level variables; the results indicate that there is no difference between boys in terms of the score on the preservation dimension of the 2-MEV. Neither the students' age nor the language spoken at home have any effect on their preservation attitudes. There is an effect of ESCS: an increase of 1 standard deviation on ESCS results in a 0.073 standard deviation higher score on

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zPRES. For environmental affect, we did observe gender differences: girls scored .167 standard deviation higher than boys. Furthermore, the results show a small effect of zESCS on zAFF: an increase of one standard deviation on zESCS results in a score of 0.063 standard deviation higher on zAFF. Again, we also split the ESCS variables into its components: zWEALTH, zCULTPOS and zHEDRES, and ran the analysis as shown in model 2. The results revealed that the low effects of zESCS on zPRES and zAFF are due to the fact that the components of ESCS have different effects. zWEALTH negatively affects zPRES, but does not affect zAFF, while zCULTPOS positively affects both zPRES and zAFF. zHEDRES has no effect on the response variables. In the final model (model 3), the school-level variable dECOSCHOOL was included in the analysis. For zAFF, the results showed no effect, for zPRES, the effect wasn't estimated since the zero model showed that the students' preservation attitudes did not differ between schools. Each consecutive model estimated for zPRES and zAFF fitted better to the data than the previous one, except for model 3.

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Discussion

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The aim of this study was to assess the effectiveness of eco-schools. We focused on environmental knowledge, attitudes and affect. Literature points towards these internal factors as a condition for achieving internalized pro-environmental behaviour (Stern *et al.*, 1995), which can be seen as the ultimate goal of environmental education.

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The instruments for assessing environmental knowledge and environmental affect were based on Leeming, *et al.'s* (1995) CHEAKS. Based on the results of factor analyses, both knowledge and affect were measured uni-dimensionally. To quantify our respondents' environmental attitudes, we used Bogner and Wiseman's (2006) two-dimensional model for ecological values (2-MEV). The results supported the two-factor higher order structure for environmental attitudes. Furthermore, the results showed environmental knowledge to be

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correlated negatively to utilization attitudes, while preservation attitudes correlated positively to environmental affect. All other correlations between the outcome variables were, though significant, marginal. These results indicate that preservation attitudes and environmental affect go together: pupils that score higher on the former also score higher on the latter. Knowing more about the environment seems to go together with holding attitudes that adhere less with the utilization dimension of the 2-MEV. On the other hand, knowledge seems to be unrelated to preservation attitudes, and environmental affect seems to be unrelated to utilization attitudes. The outcomes were examined using multivariate regression analysis, two by two, based on the correlation pattern.

The student level

At the student level, the results showed that boys know more about the environment than girls (see Table 2). This is in line with the literature on gender differences in knowledge about science in general, that shows boys to outperform girls. The results also show that children from an advantaged background (higher ESCS) perform better on the knowledge test (β=0.056). Splitting the ESCS variable into the sub-variables from which it is derived, shows that while family wealth and cultural possession at home have no effect on the respondents' scores for environmental knowledge, educational resources at home do (β=0.104). Children with high HEDRES scores (more educational resources available at home) might have a more ready access to sources on environmental topics. Since the instrument we used to tap environmental knowledge was not based on the curriculum, but rather was a measure of environmental knowledge in general, we cannot conclude that children with a higher HEDRES know more about the topics in the curriculum, or would score better on a cognitive school test concerning environmental issues. The results do however indicate that students in eco-schools know more about the environment in general. The current results do not suggest

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that high HEDRES goes together with a better environmental knowledge performance in school, but they rather suggest that such children know more about the environment in general. To discern between the two effects, further research focussing on the curriculum is needed. Furthermore the effect might be typical for knowledge about science in general and not specific to knowledge about the environment. The results also show that children who use a different language at home than the language of instruction at school, score lower on the environmental knowledge test. Though we cannot pinpoint the origin of the respondents in our sample that use different languages at home and in school, in Flanders most of these children are of Moroccan or Turkish origin. Their lower scores might be due to cultural differences (as, for example, Boeve-de Pauw & Van Petegem (2010) showed that youth environmental attitudes differ among cultures), or result from a misinterpretation of the items due to unfamiliarity with the language of the questionnaires.

Girls show more biophilic tendencies (higher AFF scores) than boys (β=-0.142). This difference might be an artefact of how girls and boys answers differently to question regarding feelings, in that girls might tend to opt for more extreme responses to feelings-related questions, resulting in a gender difference. It might, of course, also be that the difference is genuine. The student level results show that children from families with a higher cultural capital also show higher biophilic tendencies, indicating that they have more positive feelings about the natural world.

The results show no differences between boys and girls when it comes to their preservation attitudes, while they do show that boys hold attitudes that are more pro-utilization than girls. This pattern in gender differences corresponds with that of Oerke and Bogner (2010) for adults. Here, the two higher order factor structure of EA might prove to be a valuable approach to studying gender differences, as it might explain why some researchers have failed to demonstrate them (e.g. Evans *et al.*, 2007). In that respect, further research into the impact

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of the structure of EA on gender differences might unveil the discrepancies reported in the literature.

The family background (based on the PISA ESCS variable) of the respondents showed a small positive effect on preservation attitudes (an increase of 0.075 SD in zPRES with an increase of 1 zESCS) and an even smaller negative effect on utilization attitudes (a decrease of 0.037 SD in zUTIL with an increase of 1 zESCS). The directionality of these effects are as expected, but the magnitude is not. The literature often points toward socio-economic background as a major factor in explaining environmental attitudes. Again, we split the ESCS variable into its components: family wealth, cultural possessions, and home educational resources. These components have different effects that add up to the overall, small, ESCS effect. Family wealth showed to have a negative effect on preservation attitudes (β=-0.075), and no effect on utilization attitudes. Children from wealthier families hold attitudes that are less pro-preservation. This seems not to correspond with the findings of, for example, Shen and Saijo (2007) who illustrated that a higher level of income is generally associated with higher levels of environmentalism. The difference between Shen and Saijo's study and the present one is that we linked the wealth of parents to the attitudes of their offspring, and that we did not quantify the income but rather asked for the possession of items that reflect family wealth. Put correctly, our results suggest that children with parents that own items which reflect wealth, hold less pro-preservation attitudes. While family wealth has a negative effect on preservation attitudes, cultural capital has positive one (0.148 SD). The effect of cultural capital on utilization attitudes is negative (-0.108 SD). This confirms the findings of Boeve-de Pauw and Van Petegem (2010) in that the effect of the background of children should not too readily be interpreted as a single variable, and that its true impact is more nuanced and, furthermore, add that the full extent of its effect might be better understood by applying a model that structures EA on two higher order factors. Furthermore, the results suggest that

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using composite variables to measure complex constructs such as socio-economic status, might result in an oversimplification of estimates, and that research would therefore benefit from treating the components of such composite variables as separate constructs. Using non-composite variables to characterize respondents is an approach from which research programmes such as PISA (from which we derived the ESCS variable), might benefit.

Children who speak a language at home other than the official language of instruction at school (i.e. Dutch) tend to hold utilization attitudes that are less in favour of the utilization of the natural environment. As mentioned, in Flanders, most pupils that do not speak Dutch at home are of Turkish or Moroccan origin. Cultural differences in environmental attitudes have been illustrated both for adults and for children (Van Petegem & Blieck, 2006). The current results indicate that such differences might also be present within Flanders. Again, since we only discriminated between Dutch and non-Dutch as the primary language used at home, the true nature of the effect is difficult to pinpoint. Furthermore, these are surprising findings, given that previous research suggested the opposite to be true (Hunter, 2000). Further research seems appropriate since these findings might be specific to the Flemish context.

The school level

All outcome variables varied both between students and between schools, except for attitudes with regard to preservation. The highest estimated school-level variance was observed for environmental knowledge at 13.4%. For utilization attitudes the variance was estimated at 9.4%, while for environmental affect 3.8% was observed. Schools have the largest impact on the students' environmental knowledge, which fits in with the common perception that schools mainly provide their students with knowledge, but – as the results illustrate – they do also impact on attitudes and affect. The school level variances (except the one for attitudes with regard to preservation) diminished after including the student level explanatory

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variables, indicating that we are dealing with compositional effects. These occur when intergroup differences in an outcome are the result of differences in group composition, that is, in the characteristics of the individuals of whom a group is made up (Diez Roux, 2002). In other words, if individual characteristics contribute to the outcome, and these characteristics are unequally distributed across schools, then they also explain, to some extent, the differences in the outcomes between the schools. These compositional effects indicate that our respondents were not randomly distributed across schools, but were grouped within them in terms of socio-economic background and language spoken at home. After control for student characteristics, we tested the effect of the schools taking part in the eco-school programme. Summarized, children attending eco-schools did not show more biophilic tendencies, nor do they show more pro-preservation attitudes than children from non-eco-schools. They do, however, know more about the environment (0.278 SD) and have attitudes that are less centred around the utilization of the natural world (-0.196 SD). These results confirm those of Krnel and Naglic (2009) on the cognitive effect of eco-schools, as they illustrated that, in Slovenia, students attending eco-schools scored better on knowledge about the environment than student attending non-eco-schools. They did not, however, find differences between schools in terms of attitudes. The Krnel and Naglic study did not use a psychometrically validated instrument to measure attitudes, nor did it use a summative test to quantify knowledge; it compared the percentage of answers that agree with attitude statements and correct knowledge questions. Using the Bogner and Wiseman's (2006) 2-MEV, and Leeming *et al.'s* (1995) CHEAKS, our results show both a cognitive and an attitudinal effect on the part of eco-schools: eco-school students know more about the environment and have lower utilization attitudes (but equal preservation attitudes) as compared to student attending non-eco-schools.

As mentioned above, in the current study, the children's utilization attitudes correlated

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negatively (r =-.53) to knowledge about the environment, while their preservation attitudes correlated positively to environmental affect (r =.67). All other correlations between the outcome variables were only marginal. These results might suggest that utilization attitudes can be influenced through knowledge rather than through affect, and that preservation attitudes can be influenced through affect rather than through knowledge. The results of our analyses show that eco-schools have no influence on student's environmental affect, but that they do have an influence on their knowledge about the environment. A possible explanation might be that Flemish eco-schools are applying a pedagogical approach that focuses mainly on providing knowledge about the environment, and might, through such an approach, also influence their students' utilization attitudes. On the other hand, Flemish eco-schools do not seem to have an influence on their students' affect, and might therefore fail to impact on their preservation attitudes.

An explanation might be found in the common perception among educators that, when it comes to the environment, telling someone to behave in a certain way, and also giving reasonable and understandable explanations, will cause a change in that person's behaviour – in other words that teaching environmental behaviour is possible, and that this is best done by providing students with the necessary knowledge on the subject relevant to the behaviour in question (Krnel & Naglic, 2009). Teaching environmental behaviour through such a linear knowledge to behaviour model suggests that schooling is in contradiction with educational goals, since such an approach bypasses the student as a thinking individual, capable of making his or her own decisions about what constitutes responsible environmental behaviour. The history of educational sciences has illustrated that such pedagogies are not a sustainable approach to learning. More recent models on the causation of environmental behaviour (e.g. Stern, *et al.,* 1995; Stern, 2000) suggest that an educational approach that targets multiple internal factors that contribute to internalized environmental behaviour would therefore be a

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more appropriate approach. Such internal factors are environmental knowledge as well as environmental attitudes and affect, together with, for example, perceived costs and benefits, within the context of policies and social norms. Even though teaching behaviour directly is argued against, it can still be expected that eco-school do have an effect on environmental behaviour. With that in mind it would be interesting to also quantify the effect of schools participating in the eco-school programme on student environmental behaviour. Such a study could then examine how the students' environmental behaviour is related to their environmental knowledge, attitudes and affect, and how a profile such as the one observed in the case of Flemish eco-school students relates to environmental behaviour. Milfont and Duckitt (2004) showed that attitudes to preservation are linked to pro-environmental behaviour, but attitudes to utilization are not. This seems to suggest that Flemish eco-schools, by affecting utilisation attitudes and not preservation attitudes, might have little chance of changing their students' environmental behaviour. Milfont and Duckitt's (2004) results might, however, be specific for their cultural context, and further research on the link between P, U and environmental behaviour in Flanders seems necessary before we can draw any firm conclusions.

Considerations for future research

The results of the current study might, in part, be due to the effect of parental school choice. It might be the case that parents choose to send their children to schools that are actively involved in the eco-schools programme. To examine if such an effect might explain part of the results of the current study, further research is needed. A study by Creten et al. (2000) shows that, in Flanders, the most important reasons that parents list for choosing a school for their children are the perceived quality of the education and the school's reputation. An ongoing (and as yet unpublished) qualitative study produced by the authors' research unit

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shows that parents do indeed include environmental considerations in choosing a school, but it is not a dominant reason.

Eco-schools might differ in their approach to teaching environmentalism. The current study suggests that the main focus of Flemish eco-schools is (possibly involuntarily) on knowledge about the environment. Some schools might, however, focus more on feelings and attitudes as a pathway for promulgating environmentally responsible behaviour. The current study does not distinguish between the schools' pedagogical approaches. Future research might consider examining the extent to which such variation is present, and what the impact is of different pedagogical approaches on student outcomes. The schools in our sample were all three logo schools, and had obtained the final logo some years ago. It might the case that schools at the start of the process of becoming an eco-school might show a different effect on their students' environmentally-related educational outcomes. In the current study the three logo schools were considered as best practice schools, but it might be that some of these schools have lessened their efforts, as they have already obtained the highest logo possible in the eco-schools programme. These are topics for further research.

Finally, including the school characteristic ECOSCHOOL does not nullify the effect of schools on the student outcomes. Although some of the school-level variation is explained by the subsequent models, a significant proportion of school-level variation with regard to all dependent variables (except attitudes towards preservation) remains. From a school effectiveness perspective, future research might consider examining the effect of process characteristics (e.g. educational leadership, school climate, or the degree of achievement-oriented policy), as these might also help in explaining variation in the student outcomes (Scheerens, 1990).

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Figure 1.
Geographical distribution of the schools in the sample across Flanders

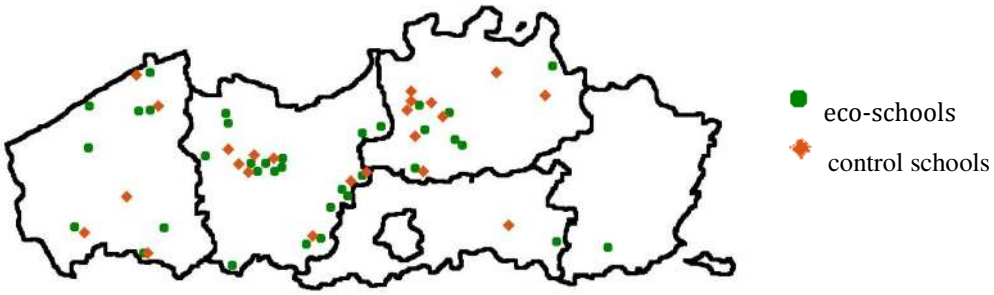

Table 1.
Scale characteristics and correlations for the four outcome variables. * marks significant correlations (all p<.001)

	Scale		Correlations			
	items	alpha	PRES	UTIL	AFF	KNOW
PRES	9	.71	1	-.034*	.667*	.165*
UTIL	10	.69		1	-.089*	-.525*
AFF	9	.87			1	.159*
KNOW	11	.66				1

Table 2.

Fixed and random coefficient estimates and standard errors for a multivariate HLM with Knowledge (zKNOW) and Utilization (zUTIL) as response variables.

	Zero model		Model 1		Model 2		Model 3	
	zKNOW	zUTIL	zKNOW	zUTIL	zKNOW	zUTIL	zKNOW	zUTIL
Fixed part								
Intercept	-0.011 (0.055)	0.012 (0.050)	-0.057 (0.061)	0.000 (0.058)	-.089 (0.104)	0.001 (0.058)	-0.091 (0.085)	0.067 (0.092)
Student level								
dBOY[c]			0.157 (0.053)*	0.125 (0.055)*	0.159 (0.055)*	0.123 (0.040)*	0.152 (0.055)*	0.100 (0.040)*
AGE			0.005 (0.028)	0.012 (0.068)	0.008 (0.028)	0.009 (0.061)	0.007 (0.028)	0.008 (0.041)
zESCS			0.056 (0.014)*	-0.037 (0.015)*				
zWEALTH					0.024 (0.028)	0.005 (0.029)	0.023 (0.028)	0.005 (0.029)
zCULTPOS					0.037 (0.028)	-0.108 (0.036)*	0.038 (0.028)	-.104 (0.0306*
zHEDRES					0.104 (0.028)*	-0.007 (0.032)	0.103 (0.028)*	-0.007 (0.032)
dLANGUAGE			0.291 (0.094)*	-0.429 (0.100)*	0.296 (0.094)*	-0.488 (0.095)*	0.295 (0.094)*	-0.468 (0.101)*
School level								
dECOSCHOOL[d]							0.278 (0.072)*	-0.196 (0.021)*
Random part								
Student level								
intercept variance	0.866 (0.035)*	0.906 (0.037)*	0.783 (0.034)*	0.859 (0.037)*	0.781 (0.033)	0.849 (0.037)	0.767 (0.033)*	0.832 (0.035)*
intercept covariance	-0.389 (0.028)*		-0.318 (0.027)*		-0.319 (0.026)		-0.312 (0.026)	
School level								
intercept variance	0.134 (0.033)*	0.094 (0.025)*	0.110 (0.029)*	0.092 (0.025)*	0.110 (0.029)	0.096 (0.027)*	0.087 (0.027)*	0.071 (0.023)*
intercept covariance	-0.085 (0.025)*		-0.066 (0.028)*		-0.067 (0.023)*		-0.065 (0.023)*	
ICC	0.134	0.094	0.123	0.096	0.123	0.102	0.101	0.078
Deviance	6725.369		5923.219*[a]		5903.825*[b]		5806.462*[a]	
Degrees of freedom	8		16		20		22	

* significant coefficients at the 5% level
[a] compared to the previous model
[b] compared to the zero model
[c] reference category is girl
[d] reference category is non-dutch as home language

Table 3.

Fixed and random coefficient estimates and standard errors for a multivariate HLM with Affection (zAFF) and Preservation (zPRES) as response variables.

	Zero model		Model 1		Model 2		Model 3	
	zAFF	zPRES	zAFF	zPRES	zAFF	zPRES	zAFF	zPRES
Fixed part								
Intercept	0.003 (0.039)	0.003 (0.032)	0.010 (0.108)	0.089 (0.105)	-0.020 (0.108)	-0.115 (0.102)	-0.025 (0.120)	-0.115 (0.102)
Student level								
dBOY[c]			-.167 (0.056)*	0.035 (0.062)	-0.152 (0.053)*	0.051 (0.058)	-0.142 (0.052)*	0.051 (0.058)
AGE			0.000 (0.032)	0.001 (0.038)	0.000 (0.033)	0.002 (0.037)	0.000 (0.033)	0.002 (0.037)
zESCS			0.063 (0.029)*	0.075 (0.028)*				
zWEALTH					-0.011 (0.031)	-0.075 (0.030)*	-0.011 (0.031)	-0.075 (0.030)*
zCULTPOS					0.100 (0.031)*	0.148 (0.032)*	0.100 (0.031)*	0.148 (0.031)*
zHEDRES					0.009 (0.031)	0.008 (0.024)	0.010 (0.031)	0.008 (0.025)
dLANGUAGE			0.079 (0.104)	0.098 (0.099)	0.091 (0.104)	0.123 (0.112)	0.092 (0.104)	0.123 (0.112)
School level								
dECOSCHOOL[d]							0.009 (0.083)	/
Random part								
Student level								
intercept variance	0.964 (0.040)*	0.985 (0.040)*	0.945 (0.041)*	0.938 (0.039)*	0.939 (0.041)*	0.920 (0.041)*	0.939 (0.041)	0.920 (0.040)*
intercept covariance	0.548 (0.033)*		0.529 (0.034)*		0.521 (0.034)*		0.520 (0.030)*	
School level								
intercept variance	0.038 (0.016)*	0.015 (0.011)	0.041 (0.017)*	0.027 (0.018)	0.041 (0.017)*	0.028 (0.017)	0.041 (0.017)*	0.029 (0.016)
intercept covariance	0.020 (0.011)		0.024 (0.013)		0.024 (0.013)		0.024 (0.013)	
ICC	0.038		0.042		0.042		0.042	
Deviance	6525.265		5829.157*[a]		5808.584*[a,b]		5812.458	
Degrees of freedom	8		16		20		22	

* significant coefficients at the 5% level
[a] compared to the previous model
[b] compared to the zero model
[c] reference category is girl
[d] reference category is non-dutch as home language

THE EFFECT OF FLEMISH ECO-SCHOOLS ON STUDENT ENVIRONMENTAL KNOWLEDGE, ATTITUDES AND AFFECT

Abstract

Eco-schools aim to improve the environment through direct and indirect effects. Direct effects are those that result from the implementation of an environmental management system. Indirect effects are educational gains. The current study examines the effectiveness of eco-schools concerning three student outcomes: (1) environmental knowledge (2) environmental attitudes and (3) environmental affect. The study includes 1287 10-12 year olds from 59 schools (38 eco-schools and 21 control schools). Multivariate multilevel regression analyses show that eco-schools mainly influence their students' environmental knowledge; they do not influence environmental affect. Eco-school students furthermore have equal preservation attitudes, and lower utilization attitudes, as compared to control-school students. The implications of these results for research and practice are discussed.

Keywords

Eco-schools; environmental knowledge; environmental attitudes; environmental affect; multivariate multilevel regression analysis.

Introduction

Since the Industrial Revolution, human activities have led to the disruption of ecosystems to an extent that is increasing exponentially. The destruction of habitats, the introduction of invasive exotic species, ever increasing pollution and over-exploitation have all lead to a degradation of the natural world that has far-reaching consequences, both for mankind and for nature (Diaz, Fargione, Chapin & Tilman, 2006). The way humanity is mistreating the earth and its natural riches in a single lifetime will impoverish our descendants for all time (Wilson, 1993). Examples are well known (loss of biodiversity, natural disasters…) and have come to occupy a prominent place, both in current affairs and in the media. An important way of raising awareness is the establishment of environmental education initiatives (or EEIs) (UNESCO, 1978; United Nations, 2005), which intend to change the way we interact with the natural environment. This is particularly important for young people, because they will ultimately be affected by, and need to provide, solutions for environmental problems arising from present-day actions. Being the future scientists, policymakers, consumers and voters, today's youth will be responsible for bettering the environment, and they will be the ones who must be persuaded to adopt and pay the costs of future environmental policies. Therefore, it appears that effective environmental education for school-age students is crucial. Eco-schools are schools that have engaged in a programme that means to (1) better the environment directly through the adoption of an environmental management system, and (2) do so indirectly, by changing the way students perceive and interact with the natural world. The current study examines the effect of eco-schools on three student outcomes: environmental knowledge, attitudes and affect.

Eco-schools

The Eco-schools International Programme operates within the framework of the Foundation for Environmental Education, a non-governmental organisation bringing together national non-governmental organisations and implementing programmes for environmental education, management and certification. The main principle of the programme is that eco-thinking should become a way of life. In this way, future consumers, manufacturers and those involved in decision-making become more sensitive to the environment. The project is based on:

- the principles of interdisciplinarity (combining natural sciences and social subjects to fully understand all aspects of a particular issue)
- a comprehensive and systematic approach (considering the complexity of environmental problems)
- activities (orientated towards the future, finding and defending different ideas, taking into account the needs of future generations)
- connecting real local environmental problems and global environmental issues, and playing an active role in democratic decision-making on environmental issues by combining cognitive emotional and aesthetic aspects.

Currently, the programme is being implemented in 47 countries around the world, involving 32,156 schools (9,898 of which have already been been certificated), 9,125,460 students, 628,005 teachers and 5,013 local authorities (Foundation for Environmental Education, 2010).

In 2005, Mogensen and Mayer published a large-scale qualitative research report on the development process of eco-schools in 13 countries. All eco-school programmes that participated in the Morgensen & Mayer study were asked for documentation and a report on the results achieved. Countries differ in the kind of results and reports produced. Almost always the report is made up of a list of victories and successes, and not as a reflection on the hurdles that were faced and the solutions found (or not, as the case may be) to deal with them.

Based on these country reports, Morgensen & Mayer (2005, p.86) conclude that '*It is too easy to degenerate into an activism devoid of content, and to join the programme for the prestige it brings, not because the schools truly believe in what they are doing'*. Furthermore, the risk is that the eco-schools programmes might consider only the technical results that are as measurable, and thus assessable, and that the eco-school programme is therefore limited to a '*…mere physical improvement in the school environment, lacking the perception of its educational effects'* (Morgensen & Mayer, 2005, p.86). An increase in the environmental performance of schools due to their participation in the programme has been demonstrated, with an increase in terms of performance with regard to water, waste, energy and greening-related aspects due to the implementation of environmental management systems (Hens, Wiedemann, Raath, Stone, Renders & Craenhals, 2010), but the extent to which eco-schools also achieve an educational gain (i.e. an increase in knowledge, attitudes, affect) in their students remains a topic that has not received the necessary attention.

Environmental knowledge, attitudes and affect

In the area of environmental education research, many researchers have used the three-component attitude model as an approach for specifying the structure of environmental attitudes (e.g. Leeming, Dwyer & Bracken, 1998). In this approach, environmental attitudes have a cognitive, an affective and a behavioural component. However, contemporary theorists tend to hold that cognition, affect and behaviour are, in fact, the bases on which the general evaluative summary of a particular psychological object is derived, instead of being the constituents of attitudes (Fabrigar, MacDonald & Wegener, 2005). It has, for instance, been argued that "*…affect, beliefs, and behaviours are seen as interacting with attitudes rather than being their parts*" (Albarracin, Zanna, Johnson & Kumkale, 2005, p.5). Therefore, even though the three component model remains the traditional view of attitude structure, new

theoretical approaches prefer to conceptualise attitudes as evaluative tendencies that can be both inferred from, and have an influence on, knowledge, affect and behaviour.

The oldest and simplest models explaining the interconnectedness between environmental attitudes and behaviours were based on a linear progression from knowledge to attitudes, which led, in turn, to pro-environmental behaviour. These models were soon proven to be too simplistic, although they are still present in common wisdom. More elaborate and complex models include other factors that influence behaviour; e.g. the theory of reasoned action (Fishbein & Azjen, 1975), which is grounded in self-interest-based and rational-choice-based deliberation. This is why individuals drive cars, for example, although they are aware of the impact of doing so on climate change. Recently, Van Petegem, Blieck and Van Ongevalle (2007) described a new perspective on this complex relationship, in which environmental attitudes influence behaviour indirectly. Specific variables, costs and social relations need to be taken into account as they interact with attitudes and beliefs. Hines' model, based on behavioural change, also focuses on additional conditions, including personality factors, knowledge of issues, and possession of skills in terms of taking action (Hines, Hungerford & Tomera, 1986/87). All these interact in an intention to act, but the ultimate behaviour is triggered by situational factors. Psychological and sociological models use different internal and external factors. Internal factors include motivation, knowledge, values, attitudes, emotional involvement and locus of control. External factors are represented by institutional, social and cultural factors. As external factors can change or even be evaded, internalised pro-environmental behaviour (Stern, Dietz & Guagnano, 1995) is supported by internal factors.

It has been about 20 years since the appearance of more complex models of change in environmental behaviour that challenged the simple linear model of knowledge through attitudes to behaviour change. The perception is, however, still common among many educators that telling someone to behave in a certain way and also giving a reasonable and

understandable explanation, will cause a change in his or her behaviour – in other words that teaching behaviour is possible (Krnel & Naglic, 2009). Courtenay-Hall and Rogers (2002) argue that shaping human behaviour as a fundamental aim of environmental education is in contradiction with at least the 50 last years of debate on educational goals. Such a behaviouristic approach is bypassing students as thinking beings, capable of making their own decisions about what constitutes responsible environmental behaviour. An educational approach that targets the internal factors (such as environmental knowledge, and environmental attitudes) that relate to environmental behaviour could therefore be key to achieving internalised responsible environmental behaviour. The influence of knowledge on behaviour is complex. While researchers agree that knowledge alone will not motivate someone to adopt a new behaviour (Schultz, 2002; Stern, 2000), it is equally clear that a lack of knowledge can be a barrier to changing behaviour (Schultz, 2002; DeYoung, 2000). Different types of knowledge can be distinguished. Procedural knowledge (how to conduct the behaviour) is worth conveying, since a lack of it could be an impediment. Similarly, impact knowledge (that describes the added value of a behaviour in achieving an environmental target) is also a valuable form of feedback. Some models include a broad background in environmental knowledge; this type of knowledge doesn't appear to separate those who engage in environmental behaviours from those who don't. Rather than directly determining behaviour, this general environmental knowledge might be instrumental in forming the values and attitudes that underlie behaviour.

Much of the research on environmental attitudes and knowledge focuses on the role of socio-demographics in explaining differences between individuals' environmental attitudes. Gender has received much attention in this field of research. Scholars generally agree that while girls are more concerned about the environment than males (Zelezny, Chua & Aldrich, 2000), they know less about environmental topics and issues (e.g. Coertjens, Boeve-de Pauw, De Maeyer

& Van Petegem, 2010). There are inconsistencies in the literature though, as some researchers have found no differences between the sexes (e.g. Evans, Brauchle, Haq, Steckler, Wong, Shapiro, 2007), while others (e.g. Oerke & Bogner, 2010) have found the genders to differ in specific environmental attitudes. A widely used approach to explain gender differences in environmentalism is based on gender roles and socialisation (Zelezny *et al.*, 2000). Socialization theory posits that individuals are shaped by gender expectations within the context of cultural norms. Females across cultures are socialized to be more expressive, to have a stronger ethic of care, and to be more interdependent, compassionate, nurturing, cooperative and helpful in care-giving roles. Males, on the other hand, are socialized to be more independent and competitive (Eagly, 1987). These differences in socialization between the sexes could then be reflected in environmental attitudes. Researchers have demonstrated that younger people tend to hold more positive attitudes than older people. In some of the literature, age appears as the strongest correlate to environmental attitudes (Arcury *et al.,* 1987). Young people are believed to be less integrated into society than are adults, and will thus more readily criticize industrial and governmental policies. Another focal point in the research on environmental attitudes is the influence of social background or socioeconomic status. Generally, research has illustrated that individuals with higher income levels are associated with knowing more about the environment (e.g. Coertjens *et al.*, 2010) and holding more positive environmental attitudes (e.g. Ozgul, Boone & Andersen, 2004; Shen & Saijo, 2007). Herera (1992) argues that people with higher income levels are more accustomed to living in healthy environments and that they therefore have beliefs that support environmental protection. The relationship between income and environmental knowledge could also be attributed to the higher educational levels that wealthier people typically achieve. Furthermore, several studies have found that higher levels of education have a positive effect on environmental attitudes (Barr, 2007; Van Liere & Dunlap, 1980). The general explanation

is that during their education, people get exposed to a broad variety of beliefs and ideas, thus encouraging a liberal-minded perspective on life. Most of the results discussed above focussed on adults; Boeve-de Pauw and Van Petegem (2010), illustrated that the social background explains variation in the environmental attitudes of children as well: children with a more advantaged economic background hold less pro-environmental attitudes; on the other hand children from families with a high cultural capital hold more pro-environmental attitudes. Several studies have shown that residence in an urban area is generally associated with greater environmentalism (e.g. Buttel, 1992). Urban dwellers are more exposed to environmental problems at first hand, and will therefore develop more pro-environmental attitudes (Tremblay & Dunlap, 1978). Alternatively, the difference in environmental attitudes between urban and rural residents has been assigned to historical-cultural differences: rural residents have a tradition of using the natural environment as a source of income and are therefore more tended to see nature as a resource than as a common good with an intrinsic value (e.g. Bogner & Wiseman, 1997; Leftridge & James, 1980).

Traditional measures for environmental attitudes have used a psychometric approach that - while multiple dimensions might be included in the instrument - applies a uni-dimensional, higher order structure. Recently Wiseman and Bogner (2003) developed an approach that has a bi-dimensional higher order structure; in this approach, environmental attitudes are hierarchically organised within two major attitude groups, or values: Preservation and Utilization. The first is an ecocentric dimension that reflects conservation and protection of the environment. The second is an anthropocentric dimension that reflects the utilization of natural resources. Milfont and Duckitt (2004) confirmed the bi-dimensional approach, and furthermore showed that preservation attitudes are linked to (self-reported) pro-environmental behaviour, while utilization values are not. The bipartition thus provides a more nuanced look at the classically assumed link between environmental behaviour and (uni-dimensional

measures of) environmental attitudes or values. A bi-dimensional model also seems consistent with the contemporary Sustainable Development (SD) debate (see Schmuck & Schultz, 2002; Schmuck & Vlek, 2003) as it does not impose a rejection of one persuasion when one accepts another, but rather allows for an integrated set of attitudes that can be (but doesn't have to be) in favour of both the preservation and utilisation of natural resources.

The main part of the literature on the effect of EEI reports on knowledge and attitudes. The importance of affect in the context of human relationships with the natural environment has been proposed by several scholars (Kaplan & Kaplan, 1989; Kals & Maes, 2002). Empirical research has found that engendering greater empathy towards nature tends to increase the level of connectedness people feel towards it (Schultz, 2000). Such empirical data support Wilson's (1984) biophillia hypothesis, which suggests that, as a species, humans have an intrinsic affiliation with the natural world. Wilson posited that the natural world continues to influence the human condition through our previous close and enduring evolutionary relationship with it. Essentially, the argument is that our technological development has been so rapid that our evolutionary adaptation to modern environments hasn't yet followed, and needs to develop substantially. Therefore, according to Wilson (1993), there is still a need to relate to nature: we have an "… innately emotional affiliation… to other organisms" (p.31). There are, however, some advocates of the biophilia hypothesis who have suggested the bond may well be a weak one, requiring the addition of culture, learning, and experience of nature to optimise biophilic tendencies (Kellert, 2002). Therefore it is an interesting approach to also include – next to knowledge and attitudes – environmental affect into the envisioned outcomes of EEI and eco-schools.

Eco-schools and the effect of environmental education interventions

Based on the PISA 2006 data, Coertjens *et al.* (2010) demonstrated that students who attend schools that organise environmental learning activities, display more pro-enviromental attitudes. The design of the study did, however, not allow the researchers to assign the effect to the schools' participation in the eco-school programme, as 'environmental learning activities' could mean different things to different schools. There is evidence that short term interventions can have educational gains. Randler, Ilg and Kern (2005) demonstrated that 9-11 year olds that took part in a conservation programme in which they encountered living animals, showed an increase in their knowledge on the subject of the programme, but not in their attitudes towards the animals they had encountered. Johnson and Manoli (2008) showed that children participating in an earth education programme (as compared to a control group) displayed an increase in their environmental attitudes. Duerden and Witt (2010) distinguished direct from indirect (learning) experiences with nature. Their findings indicated that environmental knowledge increased more than environmental attitudes during the indirect portion of their intervention and environmental education programme (i.e. a preparatory part), while the direct portion (an international workshop) produced similar levels of knowledge and attitude growth. In 2006, Smit, Jansen, van Koppen, Bulten, Damen and Custers published a report on the effects of environmental education (EE) in Dutch primary schools. The authors contacted adults by telephone and interviewed them about environmental education in the school they attended when they were children. The study shows that more EE in school results in adults who are more knowledgeable about the environment and who display more pro-environmental attitudes. Krnel and Naglic (2009) performed a study on the differences in environmental literacy between ordinary and eco-schools in Slovenia. They illustrate that though the goal of Slovenian eco-schools is to increase knowledge as well as pro-environmental attitudes and behaviour, the effect lies in the cognitive field: students from eco-

schools were shown to be more knowledgeable about environmental topics and issues, but this enhanced knowledge was not reflected in more pro-environmental attitudes.

Research Goal

The present study aims to examine the effectiveness of eco-schools in terms of their intended goals. While controlling for differences between pupils (gender, socio-economic status, home language), the following research question was central to the study: do pupils enrolled in eco-school know more about nature and the environment, do they hold more pro-environmental attitudes, and display a greater environmental affect than pupils enrolled in non-eco-schools?

Most school effectiveness studies take the schools' input characteristics and context into account in assessing the influence of process factors at the school or classroom level on output measures. Student achievement in the basic disciplines like mathematics and mother tongue are frequently used as output measures (Scheerens & Bosker, 1997). Davies (1997) emphasized, however, that the choice of output criteria does not play a neutral role, and that an excessively narrow operational definition of school effectiveness indicates an overly restricted vision on the goals of education. Given this criticism, some scholars have stressed that SE research should focus on a multitude of output measures (Reynolds & Teddlie, 1999). This includes a plea for broadening the research from solely achievement measures in mathematics and language, toward attitudes, as goals of the socializing function of the school (De Maeyer, Van den Bergh, Rymenans, Van Petegem & Rijlaarsdam, 2010). In this study, we focus on environmental knowledge, as well as on environmental attitudes and affect.

Methods

Sample

In total, 1287 pupils from 59 schools participated in the study; all were in the last year of primary education. The respondents' age ranged from 10 to 12, with a mean age of 11.23 ± 0.55; the sex ratio (boys:girls) was 0.49 with 652 girls and 626 boys (and 9 unknown). In total, 90 schools were asked to participate in the study: 45 eco-schools and 45 non-eco-schools. To control for regional differences in the sample, schools were selected based on their location. For every eco-school in the sample, a non-eco-school was selected in its vicinity (see Figure 1). The overall response-rate for schools was 66%, with an eco-school response-rate of 86%, and a non-eco-schools response-rate of 46%. 779 pupils attended one of the 39 eco-schools in the sample, and 508 pupils one of the 21 non-eco-schools schools. In each school, a single final year class was asked to participate; thus, all pupils within a school came from the same class. Classes have a mean size of 19.75 ± 7.61 pupils. There were no differences in age or sex composition between the eco-schools and the control schools. 13.9% of the respondents used another language at home other than the language of instruction at school (i.e. Dutch).

<< Insert Figure 1 about here >>

At the moment of the data collection, the eco-school project in Flanders had been up and running for 10 years. Eco-schools are accredited with three successive logos by an external jury (Sleurs, 2005). The eco-schools in our sample are among those that obtained their first eco-logo back in 2003, and their third logo in 2005. These were the first schools in Flanders to obtain an eco-school logo. Given that (1) Flemish primary education lasts six years, (2) the eco-schools in our sample obtained their first logo six years prior to the data collection, and (3) the pupils in our sample are in their last year of primary education, they had all been exposed to the eco-school project for their entire education in that school, and to the three logo state for the last four years. In Flanders, 72% of primary schools are involved in the eco-schools project at some stage (Department of Land, Nature and Energy, 2010). Those schools

that aren't involved can be considered as valuing environmental education as being of low priority in terms of school policy.

Before administering the questionnaires to the respondents, we ran a pilot study for item comprehensibility, difficulty and interpretation with a small group of 30 children. Based on the preliminary results, some items were replaced or reworded.

Measures

Outcomes variables. Three major outcomes of the eco-school programme are included in the study: environmental knowledge, environmental attitudes, and environmental affect.

Environmental knowledge (KNOW) is measured using items from the Children's Environmental Attitudes and Knowledge Scale (CHEAKS) (Leeming, Dwyer & Bracken, 1995). The original test included 30 multiple-choice questions, varying in focus across six topics: pollution, recycling, animals/biodiversity, energy, water and general. Leeming *et al.* (1995) report a Cronbach's alpha of 0.65 for the cognitive test of the CHEAKS. A pilot study resulted in an updated version of the test, consisting of 18 items: 12 original (two for each topic) and 6 new ones (one for each topic). The 12 original CHEAKS items were selected based on previous research with older respondents (aged 16-18): these were the 2 items for each of the six topics with regard to which these older youths showed the highest percentage of correct answers. All eighteen items were pre-tested for item interpretation and wording difficulties with a small group of eight children aged 10-12 (who were not included in the data collection for the present study). No problems were reported. For each item, five possible answers were provided from which the respondent chose one. Further analysis showed that eleven items were of an acceptable level of difficulty ($0.2< p <0.8$). These eleven items were used in further analyses. A sample question for the topic 'water' is "Building a dam on a river

can be harmful because it: (a) makes the river muddy (b) can no longer be used to make electricity (c) increases the level of pollution in the water (d) causes the river to flood (e) damages the river's natural ecosystem".

The pupils' environmental attitudes are measured using Bogner & Wiseman's (2006) two dimensional model of ecological values (or 2-MEV). This model for assessing environmental attitudes consists of two higher order factors (or orthogonal dimensions): Preservation (PRES) and Utilization (UTIL). Both are measured by ten items on a five point Likert scale (ranging from 'strongly disagree' to 'strongly agree', with a neutral 'agree nor disagree' in the middle). A sample item for the Preservation factor of environmental attitudes is "We must set aside areas to protect endangered species". A sample item for the Utilization factor of environmental attitudes is "We need to clear forests in order to grow crops". Bogner and Wiseman (1997) report alphas of 0.84 for P and 0.81 for U. These alphas were based on another set of items than the ones that were used in the present study (taken from Bogner & Wiseman, 2006), to measure to same construct. To our knowledge, more recent studies using the 2-MEV do not report its internal consistency.

Third, we assessed the children's affection (AFF) for the environment, as measured by Leeming *et al.'s* (1995) CHEAKS. The scale taps the concept with regard to twelve items, using a five-point Likert scale (ranging from 'strongly disagree' to 'strongly agree', with a neutral 'agree nor disagree' in the middle). A sample item is "It makes me sad to see houses being built where animals used to live". Leeming *et al.* (1995) report Cronbach's alphas ranging from 0.85 to 0.89 for an instrument that included these items on environmental affect, together with items on environmental behaviour and behavioural intention.

Explanatory variables. The pupils' socio-economic status was measured based on items taken from the Organisation for Economic Cooperation and Development (OECD)'s Programme for

International Student Assessment (PISA). The PISA index for economic, social and cultural status (ESCS), is an index created to capture wider aspects of family and home background. It is a composite variable consisting of the following (sub)variables: economic capital or possessions (WEALTH), cultural capital or possessions (CULTPOS) and home educational resources (HEDRES) of the pupils' family. We refer to the standardized indices as zESCS, zWEALTH, zCULTPOS, zHEDRES. To assess the effect of gender on the outcomes measures, we constructed a dummy variable singling out the boys in the analyses: dBOY (1=boy, 0=girl). We further included the pupils' ages (zAGE) and the language spoken at home (dLANGUAGE; 1=dutch, 0=another language). No differences in any of these explanatory variables were observed between the eco-schools and the control schools (all $p>0.05$).

While all of the above-mentioned explanatory variable are individual-level variables – they are included to explain/control for variance between individual respondents – the dummy variable that was created to contrast the eco-schools with the control schools (dECOSCHOOL: 1=eco-school, 0=control school), is included to explain variance at school level.

Analyses

The analyses for this study were performed in several steps. First we tested the dimensionality of outcome measures. For environmental knowledge and environmental affect we applied an exploratory factor analysis with an oblique rotation, a technique that allow for the factors that result from the analysis to be interrelated. Given the theoretically assumed two-dimensional structure of the children's environmental attitudes (2-MEV), we opted for a confirmatory factor analysis. We also tested the theoretically assumed independence of the different attitude factors by estimating the correlation between them.

Then, the effects of the explanatory variables on the outcome variables were assessed in a hierarchical linear model (HLM). We applied a multilevel analysis to examine which part of the variance of the outcome variables can be attributed to individual-level or to school-level characteristics. We performed the analysis in several steps. First we calculated the correlations between the four outcome variables. Based on these results, the outcome variables were combined in a multivariate design. Then we estimated a number of consecutive models, starting with a zero model (model 0, or an empty model with no explanatory variables). The purpose of the zero model was to determine the amount of variance at both levels. The zero model also allowed us to estimate the Intraclass Correlation Coefficient (ICC), which gives the proportion of the total variance that exists among groups. A low value indicates that there is little variety among groups (thus between individuals or between schools). Next, the explanatory variables were systematically included in several consecutive models. First, a model with all (and only) individual level variables was estimated. We specifically opted for the random intercept model; our main focus is not on comparing the effect of the explanatory variables between individual schools, and underpins the use of the random intercept model. Then, the individual level variables were supplemented with the school-level variable dECOSCHOOL. Again, we opted for the random intercept model. We reported the deviance of each model, indicating how well the model fits the data, and the number of estimated parameters. The use of the maximum likelihood estimation method, allowed us to use the deviances to test whether a more advanced model fits significantly better to the data than a previous model (that is nested within the more advanced model). The difference between deviances approximated a chi-square with degrees of freedom as the difference in the number of parameters of both models (Hox, 2002). Regression coefficients have to be at least 1.96 times larger then their standard error to be considered significant (Hox, 2002). The HLMs were estimated using the MLWIN 2.10 (Rasbach *et al.*, 2009)

software, the confirmatory factor analysis was performed in AMOS 18.0, and all other statistics were performed using PASW Statistics (SPSS) 18.0.

Results

Outcome variables dimensionality and characteristics

First we report the results of the analyses on the dimensionality and internal consistency for environmental knowledge and environmental affect. Next, we focus on those for the respondents' environment attitudes.

For each variable, all items were entered (for knowledge 11 items; for affect 12 items) into an exploratory factor analysis (EFA) with oblique rotation. For knowledge, the EFA initially resulted in a four factors solution. The factors explained 7.5%, 2.4%, 1.9%, and 1.2% respectively, and all had eigenvalues just above 1. Each factor contained two or three items of the eleven items included in the EFA. We opted for a uni-dimensional solution that explained more variance (18%), and showed an eigenvalue of 1.9. All eleven items relate to this factor. The response values for the eleven items were corrected for their factor loading, summated, and standardized into zKNOW. The eleven items included in zKNOW show a Cronbach's alpha of 0.66, indicating acceptable internal consistency.

The initial factor solution for environmental affect suggested two factors, explaining respectively 39.9% and 12.7% of the overall variance, and with eigenvalues of 4.78 and 1.52. Nine items related to the first factor, two to the second factor and one related equally to both factors. We removed the item that loaded on both factors. The two remaining items in the second factor weren't sufficient to define a new construct, and were therefore also omitted from the analysis. A rerun of the EFA without these three items, resulted in a one-factor solution, with an eigenvalue of 4.20, explaining 44.25% of the overall variance. The response

values for the nine items included in this factor solution were corrected for their factor loading, summated and standardized into zAFF. The nine items included in zAFF show a Cronbach's alpha of 0.87, indicating high internal consistency.

To test the two-dimensional structure of the 2-MEV, we performed a confirmatory factor analysis (CFA), that explicitly fitted the Bogner & Wismeman (2006) model to our data. All twenty items (ten for each scale) were inserted into the analysis simultaneously. All twenty items loaded significantly on their respective dimensions, except for item P4 of the preservation dimension. As this item is worded rather ambiguously: "Society will continue to solve even the biggest environmental problems", it might belong to either of the dimensions, depending on the respondents' interpretation. The item was omitted and the model was refitted, and showed a Chi^2 of 376.8 with 151 degrees of freedom ($Chi^2/df = 2.49$). A Chi^2/df ratio in the range of 2–3 is viewed as indicating an acceptable fit (Carmines & McIver, 1981). Good fit was also viewed as indicated by RMSEA, GFI and CFI respectively, having values close to .06, .95 and .95 or better (Hu & Bentler, 1999). The final model showed a good fit to the data, with fit index values for RMSEA=0.047, CFI=0.95, GFI=0.96. The correlation between the two dimensions was significant, but very low ($r = -0.036$, $p<0.001$). This segregation provides extra support for the independence of utilization and preservation attitudes. Based on the results of the CFA, zPRES and zUTIL were calculated as the standardized sum, corrected for the regression weights, of the values on each of the preservation and utilization items respectively. The attitudinal scales showed acceptable internal consistency, with a Cronbach's alpha of 0.69 for utilization and 0.71 for preservation.

Table 1 shows for each of the outcome variables, the number of items, the scale's Cronbach's alpha, and the correlations among the different outcome variables. The outcome variables show a correlation pattern of two by two: on the one hand UTIL and KNOW are negatively

correlated (r=-0.53, p<0.001), on the other PRES and AFF are positively correlated (r=0.67, p<0.001). All other correlation are, though significant (all p<0.001), small (all $r \leq 0.17$).

<< insert Table 1 about here >>

Multivariate multilevel regression analyses

Given the observed correlation pattern (see Table 1) of the outcome variables, we opted for two separate, multivariate, multilevel regression analyses. The first one models zUTIL and zKNOW simultaneously as response variables (see Table 2), while the second one models zPRES and zAFF (see Table 3).

<< insert Table 2 about here >>

The zero model (model 0) in Table 2 shows that the respondents' utilitarian attitudes differed between schools. Schools accounted for 10% of the variation between students in terms of their zUTIL scores. For zKNOW, this proportion amounted to 13.5%. Model 1 shows that boys held attitudes that are more utilitarian than girls, and also showed that boys score higher in terms of environmental knowledge. The children's age was unrelated to the response variables. There is an effect of ESCS: an increase of 1 standard deviation on ESCS results in a score of 0.056 standard deviation higher in terms of environmental knowledge. The effect of ESCS on zUTIL is negative: an increase of 1 standard deviation results in a score of 0.035 standard deviation lower score on zUTIL. This result is in contrast with the existing literature in which ESCS is a major explanatory aspect of both cognitive and attitudinal. Therefore we also split the ESCS variables into its components: zWEALTH, zCULTPOS and zHEDRES, and ran the analysis as shown in model 2. The results revealed that the low effects of zESCS on zKNOW and zUTIL are due to the fact that the sub-variables of ESCS have different effects. The results do show a positive effect of zHEDRES on zKNOW (β=0.104), and a

negative effect of zCULTPOS on zUTIL (β=-0.103). The other sub-variables have no effect on zKNOW, nor on zUTIL. The absence of effects of most of the sub-variables resulted in the overall small ESCS effect. The results also showed a positive effect with regard to speaking the same language at home as the language of instruction in school in terms of environmental knowledge (β=0.295) and a negative effect on utilization attitudes (respectively β=-0.436). At the school level, the dummy discriminating eco-schools from non-ecoschools (dECOSCHOOL) was included for both response variables, since students showed a difference between schools in their scores on both variables. Children attending eco-schools scored higher in terms of zKNOW scores (β=0.185) than did children attending non-eco-schools. This difference is supplemented with eco-school-children scoring lower on zUTIL (β=-.0308). Each consecutive model estimated for zUTIL and zKNOW fitted better to the data than the previous one. The final model shows that after control for dECOSCHOOL, schools still differed, both in their students' utilization attitudes and in their environmental knowledge.

<< insert Table 3 about here >>

Table 3 reports on the multivariate HLM in which zPRES and zAFF were examined simultaneously as response variables. The zero model in Table 3 shows that a multilevel approach is necessary. While the variance in zPRES is explained solely by the level of the individual respondents, the variance in zAFF can be assigned to both levels, with the individuals accounting for 96% and the schools for 4%. The covariance between zPRES and zAFF is significant, illustrating that a multivariate approach is necessary. The consecutive models in Table 3 were estimated to assess the effect of the individual-level explanatory variables and the school-level variable. Again, model 1 includes only individual level variables; the results indicate that there is no difference between boys in terms of the score on the preservation dimension of the 2-MEV. Neither the students' age nor the language spoken

at home have any effect on their preservation attitudes. There is an effect of ESCS: an increase of 1 standard deviation on ESCS results in a 0.073 standard deviation higher score on zPRES. For environmental affect, we did observe gender differences: girls scored .167 standard deviation higher than boys. Furthermore, the results show a small effect of zESCS on zAFF: an increase of one standard deviation on zESCS results in a score of 0.063 standard deviation higher on zAFF. Again, we also split the ESCS variables into its components: zWEALTH, zCULTPOS and zHEDRES, and ran the analysis as shown in model 2. The results revealed that the low effects of zESCS on zPRES and zAFF are due to the fact that the components of ESCS have different effects. zWEALTH negatively affects zPRES, but does not affect zAFF, while zCULTPOS positively affects both zPRES and zAFF. zHEDRES has no effect on the response variables. In the final model (model 3), the school-level variable dECOSCHOOL was included in the analysis. For zAFF, the results showed no effect, for zPRES, the effect wasn't estimated since the zero model showed that the students' preservation attitudes did not differ between schools. Each consecutive model estimated for zPRES and zAFF fitted better to the data than the previous one, except for model 3.

Discussion

The aim of this study was to assess the effectiveness of eco-schools. We focused on environmental knowledge, attitudes and affect. Literature points towards these internal factors as a condition for achieving internalized pro-environmental behaviour (Stern *et al.*, 1995), which can be seen as the ultimate goal of environmental education.

The instruments for assessing environmental knowledge and environmental affect were based on Leeming, *et al.'s* (1995) CHEAKS. Based on the results of factor analyses, both knowledge and affect were measured uni-dimensionally. To quantify our respondents' environmental attitudes, we used Bogner and Wiseman's (2006) two-dimensional model for

ecological values (2-MEV). The results supported the two-factor higher order structure for environmental attitudes. Furthermore, the results showed environmental knowledge to be correlated negatively to utilization attitudes, while preservation attitudes correlated positively to environmental affect. All other correlations between the outcome variables were, though significant, marginal. These results indicate that preservation attitudes and environmental affect go together: pupils that score higher on the former also score higher on the latter. Knowing more about the environment seems to go together with holding attitudes that adhere less with the utilization dimension of the 2-MEV. On the other hand, knowledge seems to be unrelated to preservation attitudes, and environmental affect seems to be unrelated to utilization attitudes. The outcomes were examined using multivariate regression analysis, two by two, based on the correlation pattern.

The student level

At the student level, the results showed that boys know more about the environment than girls (see Table 2). This is in line with the literature on gender differences in knowledge about science in general, that shows boys to outperform girls. The results also show that children from an advantaged background (higher ESCS) perform better on the knowledge test (β=0.056). Splitting the ESCS variable into the sub-variables from which it is derived, shows that while family wealth and cultural possession at home have no effect on the respondents' scores for environmental knowledge, educational resources at home do (β=0.104). Children with high HEDRES scores (more educational resources available at home) might have a more ready access to sources on environmental topics. Since the instrument we used to tap environmental knowledge was not based on the curriculum, but rather was a measure of environmental knowledge in general, we cannot conclude that children with a higher HEDRES know more about the topics in the curriculum, or would score better on a cognitive

school test concerning environmental issues. The results do however indicate that students in eco-schools know more about the environment in general. The current results do not suggest that high HEDRES goes together with a better environmental knowledge performance in school, but they rather suggest that such children know more about the environment in general. To discern between the two effects, further research focussing on the curriculum is needed. Furthermore the effect might be typical for knowledge about science in general and not specific to knowledge about the environment. The results also show that children who use a different language at home than the language of instruction at school, score lower on the environmental knowledge test. Though we cannot pinpoint the origin of the respondents in our sample that use different languages at home and in school, in Flanders most of these children are of Moroccan or Turkish origin. Their lower scores might be due to cultural differences (as, for example, Boeve-de Pauw & Van Petegem (2010) showed that youth environmental attitudes differ among cultures), or result from a misinterpretation of the items due to unfamiliarity with the language of the questionnaires.

Girls show more biophilic tendencies (higher AFF scores) than boys (β=-0.142). This difference might be an artefact of how girls and boys answers differently to question regarding feelings in that girls might tend to opt for more extreme responses to feelings-related questions, resulting in a gender difference. It might, of course, also be that the difference is genuine. The student level results show that children from families with a higher cultural capital also show higher biophilic tendencies, indicating that they have more positive feelings about the natural world.

The results show no differences between boys and girls when it comes to their preservation attitudes, while they do show that boys hold attitudes that are more pro-utilization than girls. This pattern in gender differences corresponds with that of Oerke and Bogner (2010) for adults. Here, the two higher order factor structure of EA might prove to be a valuable

approach to studying gender differences, as it might explain why some researchers have failed to demonstrate them (e.g. Evans *et al.*, 2007). In that respect, further research into the impact of the structure of EA on gender differences might unveil the discrepancies reported in the literature.

The family background (based on the PISA ESCS variable) of the respondents showed a small positive effect on preservation attitudes (an increase of 0.075 SD in zPRES with an increase of 1 zESCS) and an even smaller negative effect on utilization attitudes (a decrease of 0.037 SD in zUTIL with an increase of 1 zESCS). The directionality of these effects are as expected, but the magnitude is not. The literature often points toward socio-economic background as a major factor in explaining environmental attitudes. Again, we split the ESCS variable into its components: family wealth, cultural possessions, and home educational resources. These components have different effects that add up to the overall, small, ESCS effect. Family wealth showed to have a negative effect on preservation attitudes (β=-0.075), and no effect on utilization attitudes. Children from wealthier families hold attitudes that are less pro-preservation. This seems not to correspond with the findings of, for example, Shen and Saijo (2007) who illustrated that a higher level of income is generally associated with higher levels of environmentalism. The difference between Shen and Saijo's study and the present one is that we linked the wealth of parents to the attitudes of their offspring, and that we did not quantify the income but rather asked for the possession of items that reflect family wealth. Put correctly, our results suggest that children with parents that own items which reflect wealth, hold less pro-preservation attitudes. While family wealth has a negative effect on preservation attitudes, cultural capital has positive one (0.148 SD). The effect of cultural capital on utilization attitudes is negative (-0.108 SD). This confirms the findings of Boeve-de Pauw and Van Petegem (2010) in that the effect of the background of children should not too readily be interpreted as a single variable, and that its true impact is more nuanced and,

furthermore, add that the full extent of its effect might be better understood by applying a model that structures EA on two higher order factors. Furthermore, the results suggest that using composite variables to measure complex constructs such as socio-economic status, might result in an oversimplification of estimates, and that research would therefore benefit from treating the components of such composite variables as separate constructs. Using non-composite variables to characterize respondents is an approach from which research programmes such as PISA (from which we derived the ESCS variable), might benefit.

Children who speak a language at home other than the official language of instruction at school (i.e. Dutch) tend to hold utilization attitudes that are less in favour of the utilization of the natural environment. As mentioned, in Flanders, most pupils that do not speak Dutch at home are of Turkish or Moroccan origin. Cultural differences in environmental attitudes have been illustrated both for adults and for children (Van Petegem & Blieck, 2006) The current results indicate that such differences might also be present within Flanders. Again, since we only discriminated between Dutch and non-Dutch as the primary language used at home, the true nature of the effect is difficult to pinpoint. Furthermore, these are surprising findings, given that previous research suggested the opposite to be true (Hunter, 2000). Further research seems appropriate since these findings might be specific to the Flemish context.

The school level

All outcome variables varied both between students and between schools, except for attitudes with regard to preservation. The highest estimated school-level variance was observed for environmental knowledge at 13.4%. For utilization attitudes the variance was estimated at 9.4%, while for environmental affect 3.8% was observed. Schools have the largest impact on the students' environmental knowledge, which fits in with the common perception that schools mainly provide their students with knowledge, but – as the results illustrate – they do

also impact on attitudes and affect. The school level variances (except the one for attitudes with regard to preservation) diminished after including the student level explanatory variables, indicating that we are dealing with compositional effects. These occur when intergroup differences in an outcome are the result of differences in group composition, that is, in the characteristics of the individuals of whom a group is made up (Diez Roux, 2002). In other words, if individual characteristics contribute to the outcome, and these characteristics are unequally distributed across schools, then they also explain, to some extent, the differences in the outcomes between the schools. These compositional effects indicate that our respondents were not randomly distributed across schools, but were grouped within them in terms of socio-economic background and language spoken at home. After control for student characteristics, we tested the effect of the schools taking part in the eco-school programme. Summarized, children attending eco-schools did not show more biophilic tendencies, nor do they show more pro-preservation attitudes than children from non-eco-schools. They do, however, know more about the environment (0.278 SD) and have attitudes that are less centred around the utilization of the natural world (-0.196 SD). These results confirm those of Krnel and Naglic (2009) on the cognitive effect of eco-schools, as they illustrated that, in Slovenia, students attending eco-schools scored better on knowledge about the environment than student attending non-eco-schools. They did not, however, find differences between schools in terms of attitudes. The Krnel and Naglic study did not use a psychometrically validated instrument to measure attitudes, nor did it use a summative test to quantify knowledge; it compared the percentage of answers that agree with attitude statements and correct knowledge questions. Using the Bogner and Wiseman's (2006) 2-MEV, and Leeming *et al.'s* (1995) CHEAKS, our results show both a cognitive and an attitudinal effect on the part of eco-schools: eco-school students know more about the environment and have lower utilization attitudes (but equal preservation attitudes) as compared to student attending

non-eco-schools.

As mentioned above, in the current study, the children's utilization attitudes correlated negatively (r =-.53) to knowledge about the environment, while their preservation attitudes correlated positively to environmental affect (r =.67). All other correlations between the outcome variables were only marginal. These results might suggest that utilization attitudes can be influenced through knowledge rather than through affect, and that preservation attitudes can be influenced through affect rather than through knowledge. The results of our analyses show that eco-schools have no influence on student's environmental affect, but that they do have an influence on their knowledge about the environment. A possible explanation might be that Flemish eco-schools are applying a pedagogical approach that focuses mainly on providing knowledge about the environment, and might, through such an approach, also influence their students' utilization attitudes. On the other hand, Flemish eco-schools do not seem to have an influence on their students' affect, and might therefore fail to impact on their preservation attitudes.

An explanation might be found in the common perception among educators that, when it comes to the environment, telling someone to behave in a certain way, and also giving reasonable and understandable explanations, will cause a change in that person's behaviour – in other words that teaching environmental behaviour is possible, and that this is best done by providing students with the necessary knowledge on the subject relevant to the behaviour in question (Krnel & Naglic, 2009). Teaching environmental behaviour through such a linear knowledge to behaviour model suggests that schooling is in contradiction with educational goals, since such an approach bypasses the student as a thinking individual, capable of making his or her own decisions about what constitutes responsible environmental behaviour. The history of educational sciences has illustrated that such pedagogies are not a sustainable approach to learning. More recent models on the causation of environmental behaviour (e.g.

Stern *et al.,* 1995; Stern, 2000) suggest that an educational approach that targets multiple internal factors that contribute to internalized environmental behaviour would therefore be a more appropriate approach. Such internal factors are environmental knowledge as well as environmental attitudes and affect, together with, for example, perceived costs and benefits, within the context of policies and social norms. Even though teaching behaviour directly is argued against, it can still be expected that eco-school do have an effect on environmental behaviour. With that in mind it would be interesting to also quantify the effect of schools participating in the eco-school programme on student environmental behaviour. Such a study could then examine how the students' environmental behaviour is related to their environmental knowledge, attitudes and affect, and how a profile such as the one observed in the case of Flemish eco-school students relates to environmental behaviour. Milfont and Duckitt (2004) showed that preservation attitudes are linked to pro-environmental behaviour, but utilization attitudes are not. This seems to suggest that Flemish eco-schools, by affecting utilisation attitudes and not preservation attitudes, might have little chance of changing their students' environmental behaviour. Milfont and Duckitt's (2004) results might, however, be specific for their cultural context, and further research on the link between P, U and environmental behaviour in Flanders seems necessary before we can draw any firm conclusions.

Considerations for future research

The results of the current study might, in part, be due to the effect of parental school choice. It might be the case that parents choose to send their children to schools that are actively involved in the eco-schools programme. To examine if such an effect might explain part of the results of the current study, further research is needed. A study by Creten et al. (2000) shows that, in Flanders, the most important reasons that parents list for choosing a school for

their children are the perceived quality of the education and the school's reputation. An ongoing (and as yet unpublished) qualitative study produced by the authors' research unit shows that parents do indeed include environmental considerations in choosing a school, but it is not a dominant reason.

Eco-schools might differ in their approach to teaching environmentalism. The current study suggests that the main focus of Flemish eco-schools is (possibly involuntarily) on knowledge about the environment. Some schools might, however, focus more on feelings and attitudes as a pathway for promulgating environmentally responsible behaviour. The current study does not distinguish between the schools' pedagogical approaches. Future research might consider examining the extent to which such variation is present, and what the impact is of different pedagogical approaches on student outcomes. The schools in our sample were all three logo schools, and had obtained the final logo some years ago. It might the case that schools at the start of the process of becoming an eco-school might show a different effect on their students' environmentally-related educational outcomes. In the current study the three logo schools were considered as best practice schools, but it might be that some of these schools have lessened their efforts, as they have already obtained the highest logo possible in the eco-schools programme. These are topics for further research.

Finally, including the school characteristic ECOSCHOOL does not nullify the effect of schools on the student outcomes. Although some of the school-level variation is explained by the subsequent models, a significant proportion of school-level variation with regard to all dependent variables (except preservation attitudes) remains. From a school effectiveness perspective, future research might consider examining the effect of process characteristics (e.g. educational leadership, school climate, or the degree of achievement-oriented policy), as these might also help in explaining variation in the student outcomes (Scheerens, 1990).

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Figure 1.

Geographical distribution of the schools in the sample across Flanders

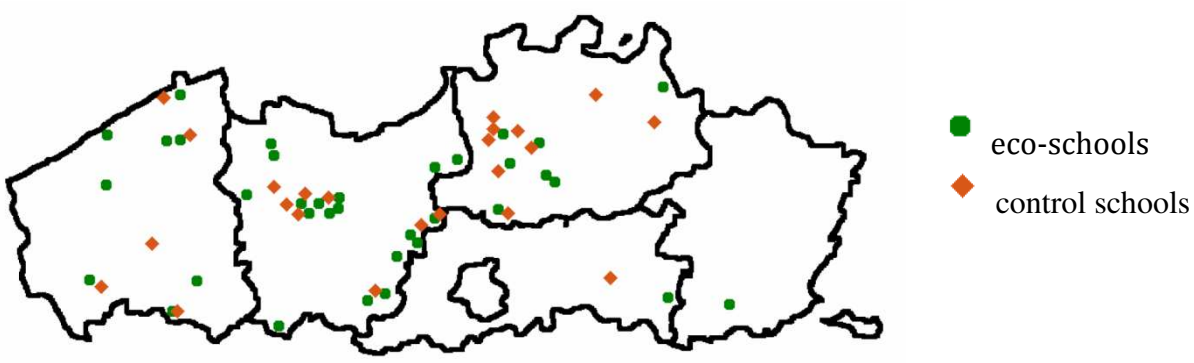

Table 1.
Scale characteristics and correlations for the four outcome variables. * marks significant correlations (all p<.001)

	Scale		Correlations			
	items	alpha	PRES	UTIL	AFF	KNOW
PRES	9	.71	1	-.034*	.667*	.165*
UTIL	10	.69		1	-.089*	-.525*
AFF	9	.87			1	.159*
KNOW	11	.66				1

Table 2.

Fixed and random coefficient estimates and standard errors for a multivariate HLM with Knowledge (zKNOW) and Utilization (zUTIL) as response variables.

	Zero model		Model 1		Model 2		Model 3	
	zKNOW	zUTIL	zKNOW	zUTIL	zKNOW	zUTIL	zKNOW	zUTIL
Fixed part								
Intercept	-0.011 (0.055)	0.012 (0.050)	-0.057 (0.061)	0.000 (0.058)	-.089 (0.104)	0.001 (0.058)	-0.091 (0.085)	0.067 (0.092)
Student level								
dBOY[c]			0.157 (0.053)*	0.125 (0.055)*	0.159 (0.055)*	0.123 (0.040)*	0.152 (0.055)*	0.100 (0.040)*
AGE			0.005 (0.028)	0.012 (0.068)	0.008 (0.028)	0.009 (0.061)	0.007 (0.028)	0.008 (0.041)
zESCS			0.056 (0.014)*	-0.037 (0.015)*				
zWEALTH					0.024 (0.028)	0.005 (0.029)	0.023 (0.028)	0.005 (0.029)
zCULTPOS					0.037 (0.028)	-0.108 (0.036)*	0.038 (0.028)	-.104 (0.0306*
zHEDRES					0.104 (0.028)*	-0.007 (0.032)	0.103 (0.028)*	-0.007 (0.032)
dLANGUAGE			0.291 (0.094)*	-0.429 (0.100)*	0.296 (0.094)*	-0.488 (0.095)*	0.295 (0.094)*	-0.468 (0.101)*
School level								
dECOSCHOOL[d]							0.278 (0.072)*	-0.196 (0.021)*
Random part								
Student level								
intercept variance	0.866 (0.035)*	0.906 (0.037)*	0.783 (0.034)*	0.859 (0.037)*	0.781 (0.033)	0.849 (0.037)	0.767 (0.033)*	0.832 (0.035)*
intercept covariance	-0.389 (0.028)*		-0.318 (0.027)*		-0.319 (0.026)		-0.312 (0.026)	
School level								
intercept variance	0.134 (0.033)*	0.094 (0.025)*	0.110 (0.029)*	0.092 (0.025)*	0.110 (0.029)	0.096 (0.027)*	0.087 (0.027)*	0.071 (0.023)*
intercept covariance	-0.085 (0.025)*		-0.066 (0.028)*		-0.067 (0.023)*		-0.065 (0.023)*	
ICC	0.134	0.094	0.123	0.096	0.123	0.102	0.101	0.078
Deviance	6725.369		5923.219*,[a]		5903.825*,[b]		5806.462*,[a]	
Degrees of freedom	8		16		20		22	

* significant coefficients at the 5% level
[a] compared to the previous model
[b] compared to the zero model
[c] reference category is girl
[d] reference category is non-dutch as home language

Table 3.

Fixed and random coefficient estimates and standard errors for a multivariate HLM with Affection (zAFF) and Preservation (zPRES) as response variables.

	Zero model		Model 1		Model 2		Model 3	
	zAFF	zPRES	zAFF	zPRES	zAFF	zPRES	zAFF	zPRES
Fixed part								
Intercept	0.003 (0.039)	0.003 (0.032)	0.010 (0.108)	0.089 (0.105)	-0.020 (0.108)	-0.115 (0.102)	-0.025 (0.120)	-0.115 (0.102)
Student level								
dBOY[c]			-.167 (0.056)*	0.035 (0.062)	-0.152 (0.053)*	0.051 (0.058)	-0.142 (0.052)*	0.051 (0.058)
AGE			0.000 (0.032)	0.001 (0.038)	0.000 (0.033)	0.002 (0.037)	0.000 (0.033)	0.002 (0.037)
zESCS			0.063 (0.029)*	0.075 (0.028)*				
zWEALTH					-0.011 (0.031)	-0.075 (0.030)*	-0.011 (0.031)	-0.075 (0.030)*
zCULTPOS					0.100 (0.031)*	0.148 (0.032)*	0.100 (0.031)*	0.148 (0.031)*
zHEDRES					0.009 (0.031)	0.008 (0.024)	0.010 (0.031)	0.008 (0.025)
dLANGUAGE			0.079 (0.104)	0.098 (0.099)	0.091 (0.104)	0.123 (0.112)	0.092 (0.104)	0.123 (0.112)
School level								
dECOSCHOOL[d]							0.009 (0.083)	/
Random part								
Student level								
intercept variance	0.964 (0.040)*	0.985 (0.040)*	0.945 (0.041)*	0.938 (0.039)*	0.939 (0.041)*	0.920 (0.041)*	0.939 (0.041)	0.920 (0.040)*
intercept covariance	0.548 (0.033)*		0.529 (0.034)*		0.521 (0.034)*		0.520 (0.030)*	
School level								
intercept variance	0.038 (0.016)*	0.015 (0.011)	0.041 (0.017)*	0.027 (0.018)	0.041 (0.017)*	0.028 (0.017)	0.041 (0.017)*	0.029 (0.016)
intercept covariance	0.020 (0.011)		0.024 (0.013)		0.024 (0.013)		0.024 (0.013)	
ICC	0.038		0.042		0.042		0.042	
Deviance	6525.265		5829.157*[a]		5808.584*[b]		5812.458	
Degrees of freedom	8		16		20		22	

* significant coefficients at the 5% level
[a] compared to the previous model
[b] compared to the zero model
[c] reference category is girl
[d] reference category is non-dutch as home language

THE EFFECT OF FLEMISH ECO-SCHOOLS ON STUDENT ENVIRONMENTAL KNOWLEDGE, ATTITUDES AND AFFECT

Revisions Table

Reviewers' comments	Authors' response
REVIEWER 1	
1.) In General:	
- The constructs should be used consistently (e.g. the construct 'environmental knowledge'; on page 1, line 28-30 the construct is called 'knowledge about the nature and the environment', later on it is called 'knowledge about the environment'). Please decide for one single construct.	We now consistently use the term environmental knowledge throughout the introduction. Readers can learn the full content of the construct in the methods section.
- The term environmental affect is not precisely defined. As attitudes are a subcategory of affective variables, I guess the authors suppose to use the construct 'emotion' instead of 'affect'? Please change or explain in more detail.	Some researchers have indeed considered attitudes as a subcategory of affective variables. Others have defined the relation the other way around: affect - together with behaviour and cognition - as a component of attitudes. However, contemporary theorists tend to hold that cognition, affect and behaviour are in fact the bases from which the general evaluative summary of a particular psychological object is derived, instead of being the constituents of attitudes. Affect, beliefs, knowledge and behaviours are seen as interacting with attitudes rather than being their parts. This new theoretical approach prefers to conceptualise attitudes as evaluative tendencies that can be both inferred from and have an influence on knowledge, affect, and behaviour. The first paragraph of section 1.2 provides theory and references on this issue.
2.) Introduction/Theoretical Background:	
- I would suggest re-ordering the theoretical background: As the whole study is politically motivated, I would start with paragraph 1.2 (starting at page 7, line 44), followed by paragraph 1.1. (starting at page 2, line 54). I	We agree, and have made these changes.

would finish with paragraph 1.3. (page 9, line 28-page 10, line 27).	
- Within paragraph 1.1. there is a strong focus on attitudes (and beliefs) and how they influence behavior. Perhaps it is possible to include some facts on environmental knowledge and emotions, as there is a strong focus on these two variables within your paper.	- Section 1.2 ends with a paragraph that provides theory on environmental affect (emotions), and which argues why it is interesting to include this construct as an outcome. - Halfway through p6, a paragraph on environmental knowledge was added
- Page 7, line 56/57: The program should not only influence attitudes but also knowledge and emotion, otherwise it would not be useful to evaluate all three constructs (compare: http://www.eco-schools.org/).	True. We have deleted the sentence in question since, given the re-ordering of the introduction, it is superfluous. It can now no longer cause confusion on the aims on the project or of the study.
- Page 7, line 47: International hast to be written in a capital letter.	We have made this adaptation
- Please decide for one kind of spelling concerning the word program/programme (e.g. page 7, line 54 and page 8, line 45).	We have made this adaptation
3.) Methods:	
- Please include the pupils' grade within this part (page 11, line 22). It comes a little bit late on page 12.	The first sentence of the section describing the sample includes the pupils' grade (last year of primary education). This is repeated later on (p12).
- Did you find differences between experimental and control-groups concerning the mother tongue (page 11, line 50). Please add already one sentence in the methods	We did not observe differences between the eco-schools and the control schools for language spoken at home; nor did we observe differences for any of the other individual-level explanatory variables. We included a sentence on this near the end of '3.2.2 explanatory variables'
- Is it possible that there are huge differences concerning the parents of the two groups? Do pupils always go to that school that is nearest to their parents' home or do the parents decide to which school their children go. Please add one sentence already in the method.	It is true that in the current study we cannot control for the effect of the parents' influence in school choice. It might be so that parents choose to send their children to schools that are actively involved in the eco-schools programme. A study by Creten et al. (2000) has shown that, in Flanders, the most important reasons that parents list for choosing a schools for their child are the perceived quality of the education and the school's

	reputation. An ongoing (and as yet unpublished) qualitative study in our own research unit shows that parents do indeed include environmental considerations, but not as 'the' dominant reason for choosing a school for their kids. We have included a paragraph on this issue at the end of the discussion (under 5.3 considerations for future research).
- Page 13, line 15/16: Please put abbreviations in parentheses: (2-MEV) and explain new abbreviations like 'EA-Model' for 'environmental attitudes' (page 13, line 16) or CHEAKS (page 13, line 35) or EEI (page 7, line 1) or EE (page 10, line1) by using it the first time.	We have made these changes for 2MEV and EE. The abbreviation CHEAKS is not new at this point in the manuscript, as it is explained in the beginning of the 3.2.1. EEI is explained early on in the introduction, so it not new either.
- Page 15, line 34: the use of the maximum likelihood estimation model (include 'of')	We have made this adaptation
4.) Discussion:	
- For the reader it would be much easier if you used not only the abbreviations for the scales (e.g. ESCS, HERDRES) but the meaning of the scales.	To facilitate reading the discussion, we have included the meaning of the scales, where useful.
- Page 21, line 27: "… or know more about": What do you mean by these words?	A part of this sentence got lost in the submitted manuscript. We have reincluded it.
- Especially in the discussion an English proofreading would be useful (e.g. page 27, line 10-13: "The school is our sample were all logo three schools …"	It is true that our mother tongue is not English. The entire manuscript has now been proof read by a native speaker.
- As the discussion seems to be very descriptive and a sequencing of results it seems perhaps possible to structure it a little bit more concerning the most important results.	In the discussion, a distinction is made between the levels of analysis. The individual levels focuses mainly on the different effects of the socio-economic variables, while the school level's focus is on the effect of participation in the eco-schools programme. A third and last part focuses on considerations for future research.
REVIEWER 2	
GENERAL COMMENTS	
-You have a few type-o's that you need to catch.	The entire manuscript has now been proof read by a native

	speaker, so they should be gone.
INTRODUCTION & RATIONALE	
-Your rationale seems sound	
-pg2 ln46 You may need to further explain what is meant by "greening" schools. This may not be clear to international readers.	We have replaced “greening the school” with “the adoption of an environmental management system”
-pg3 ln37 Can you explain the Theory of Reasoned Action more thoroughly as I'm slightly confused. You state that the theory claims that action is "rational", but then the example you give is of "irrational" behavior (or a behavior not predicated on purely mathematical calculations)	We have changed the passage to “More elaborate and complex models include other factors that influenced behaviour; e.g. the theory of reasoned action, which is grounded in self-interest-based and rational-choice-based deliberation. This is why they (e.g.) drive cars, although they are aware of climate change.” This now includes that acts are not only based on knowledge and favourable attitudes, but also on other factors such as self-interest. This is and example of the expansion and more complex and non-linear approach to explaining behaviours.
-pg6 Please explain why bi-dimensional models are consistent with the Sustainable Development debate as you provide no rationale for this statement	This passage now reads “A bi-dimensional model also seems consistent with the contemporary Sustainable Development, as it does not impose a rejection of one persuasion when one accepts another, but rather allows for an integrated set of attitudes that can (but doesn’t have to be) in favour of both the preservation and utilisation of natural resources.”
-In section 1.1 You list a number of background theories on attitude, but leave me unclear as why they were necessary to lead to your rationale for using the bi-dimensional model for your study. In other words, what about the reviewed theories led you to select that one in particular?	That passage ends with a rationale for choosing the model we chose. We argue that it provides a more nuanced approach to measuring environmental attitudes, and that it coheres with the sustainable development debate. This last argument has now been motivated more fully (see comment above).
METHODS/RESULTS	
-Fig 1: You might want to provide a country context as reference (ie a small version of the country of Finland, so the reader can locate your	We are willing to change/improve Figure 1, but maybe we’re misunderstanding what the

geographic sampling area it not familiar with the area	reviewer is asking here. The Figure already is a small version of the Flemish region. Including neighbouring countries would increase the figure's size and reduce the size its informative part. (And Finland doesn't come into the picture at all).
-I am ignorant of what "cumulative logo" is? If that is just me, that is fine, but I'm not sure all international readers will know what that is without an explanation.	We meant to say "successive logos". We now no more refer to cumulative logos.
-pg12 ln54 You provide absolutely no rationale for dropping 12 of the questions... why would you just do this?	The passage has been expanded, and now provides more information on how we did this: "The pilot study resulted in an updated version of the test, consisting of 18 items: 12 original (two for each topic) and 6 new ones (one for each topic). The 12 original items were selected based on previous research with older respondents (aged 16-18): these were the 2 items for each of the six topics on which these older youths showed the highest percentage of correct answers. All eighteen items were pre-tested for interpretation of the items and wording difficulties in a small group of eight children aged 10-12 (these were not included in the data collection for the present study). No problems were reported."
-You provide no validity/reliability data for the 2-MEV and CHEAKS instruments from the studies in which they were previously used. I understand you conducted your own construct/item analysis as well, but it would be useful to have these numbers for comparison.	We have now provided information on the alphas reported by the authors that first published the instruments, in the methods section. However, given that we did not use the exact same sets of items – e.g. we used the items taken from Bogner & Wiseman (2006), but alphas are only reported in Bogner and Wiseman (1997), which uses a different set of items – and operated in a different cultural context (e.g. Belgium vs Ireland vs Germany), comparisons between these

	original alphas and the ones reported in the present study do not tell much about the instrument in general, but rather about the internal consistency of the instrument within the context of the different studies. We did however include them.
-Section 4.1: Why would you choose to drop the three affect items that did not "hang" with the others instead of defining a new construct. It seems to me, you are selecting questions out of convenience with those that "hang" together and just dropping those that don't fit your factor analysis model. Just dropping those items that don't correlate to one factor is difficult for me to understand without an explicit (non-mathematical) rationale. Especially if these items were used in previous studies and were intercorrelated. Again, this is where reporting validity/reliability from previous studies would help your argument.	We didn't just drop the three items out of convenience. We first removed the item that loaded on both factors. The number of remaining items (2) wasn't sufficient to define a new construct. We have now explained this in more detail in the results section. We know of no previous research that has applied EFA to this particular instrument, so we cannot compare.
-The HLM model is sound and does yield some interesting results, but because I don't have all the information I would like in how you defined your constructs, it is difficult for me to jump on board fully.	OK
DISCUSSION	
-Is thorough and explains/addresses all your results well.	OK