



The relationship of childhood upbringing and university degree program to environmental identity: experience in nature matters

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ABSTRACT

Education has been proposed as an important way to increase environmental concern. Beyond providing information, education could also encourage a stable sense of oneself as connected to the natural world, or environmental identity (EID), which is a predictor of environmental concern and behavior. This study explored the relative roles of environmental education at university and previous personal characteristics on the level of individual EID. Results from a questionnaire distributed to 919 French students in different academic curricula (ecology, other sciences and political sciences) showed significant difference in levels of EID for students in ecology compared to others, but also that EID was strongly influenced by personal experiences of nature and social context regarding conservation. These results suggest that academic curriculum is more a result than a cause for high environmental identity. We discuss the results in terms of education and access to nature for children and young people.

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Introduction

The current biodiversity crisis will not be solved without wide involvement of individuals toward this issue (Wilshusen et al. 2002). However, despite widely distributed education campaigns and official discourses and injunctions, individual attitudes toward biodiversity are not changing. For instance, in 2013, less than half of Europeans interviewed (46%) declared that they knew the term 'biodiversity' and 26% said they had never heard about it. Fewer than half of them (45%) felt informed about biodiversity loss (European Commission 2013). Education has been proposed as the most important process to increase individual awareness and attention to issues of biodiversity and conservation (Brewer 2002), and biodiversity functioning and conservation issues have been highly popularized through education channels (Gayford 2000).

Traditionally, education has been conceptualized as the creation of knowledge through information transfer. Although knowledge is an important foundation (Gifford and Nilsson 2014), knowledge by itself is not hugely successful at creating environmental concern and awareness (Abrahamse et al. 2005). A more modern understanding suggests that education can have multiple functions, including changing attitudes, behaviors and self-perceptions (e.g. Sauvé and van Steenberghe 2015). For their

part, pro-environmental attitudes and behaviors are embedded in social, political and economic contexts, but depend also on individual identity and values (Kollmuss and Agyeman 2002). Among multiple complementary outcomes, environmental education could therefore help people change their identity toward nature, and feel more connected to environmental issues. Indeed, a sense of connection to nature can elicit an emotional or empathic response to the natural world and to the challenges it faces, which in turn motivates concern and action (Clayton 2012).

The idea of a connection to nature has generated a large amount of research over the past few decades. Schultz (2001) developed the inclusion of nature in the self (INS) scale to assess the extent to which people felt a sense that they were intimately connected to the natural world, finding that it was significantly correlated with concern about natural entities (plants, marine life, animals, and birds) as well as with a measure of empathy. Feeling connected to nature is a transitory experience that could be activated by an exposure to nature (Mayer et al. 2009), e.g. on a walk. As an educational outcome, however, a longer-lasting effect is desirable. McGuire (2015) suggests that such an outcome can be found in *identity*: a somewhat stable sense of oneself that is 'not easily or quickly adapted to or bent by new situations and contexts, yet still constructed or developed so as to be shapeable' (696). An environmental identity could be a possible outcome of an environmental education program.

Environmental identity (Clayton 2003, 2012), is a stable sense of oneself as interdependent with the natural world. Individual identities are multiple and they vary in salience depending on circumstances, so that an environmental identity can co-exist with other identities such as parent or teacher, and it may take a back seat when the parent or teacher identity is paramount. However, having a high environmental identity is correlated with more attention and concern directed toward environmental topics, as well as with pro-environmental behavior. Identities are formed over time on the basis of experience, particularly during child individual and social development. The shaping of an environmental identity has mostly been investigated through significant life experience research, which has found through retrospective accounts that adult environmental leaders attribute their engagement with environmental issues to early experiences with nature, often in the company of significant others (e.g. Chawla 1999). As reported by Palmer (1993), the strongest predictor of environmental concern among environmental educators from around the world was the amount of outdoor experience they had as children. Young (age 16–19) environmental leaders also emphasize early experiences with nature as well as influential social experiences (Arnold, Cohen, and Warner 2009).

Role of education in the development of environmental identity

What is the potential role of education in the development of environmental identity among young adults? We know of little research on this topic. Research on the effectiveness of environmental education indicates that direct experiences in nature matter in affecting attitudes and behavior, and in fact that experiences in nature may serve to create (or activate) a link between knowledge and behavior (Duerden and Witt 2010). But most of this research has focused on primary and secondary education, when the curriculum is fairly general. If we want to increase a sense of environmental identity among adults, we might consider the kinds of specific, targeted information found in advanced degree programs that are related to environmental issues or the natural world.

As noted by Arnocky and Stroink (2011), differences among individuals in specific degree programs do not necessarily reflect a causal impact of the program. Individuals tend to choose a discipline based on pre-existing interests and values. Thus it is not surprising that students majoring in an outdoor recreation, parks, and tourism program scored higher on environmental concern and self-reported behavior than students in other majors (Arnocky and Stroink 2011). Using an online simulation, Cuadrado et al. (2015) found that environmental studies students in Spain made significantly more pro-environmental choices than education students. In a large Chilean sample, Heyl, Moyano-Diaz and Cifuentes (2013) found more pro-environmental attitudes and behavior among students in environmental programs compared to those in other programs; they did not find differences associated with year of study, but they report a 'slightly positive trend' in environmental attitudes associated with advancement through

the degree program. Higher education can make a difference, however: Kuo and Jackson (2014) found an increase in scores on an environmental attitude measure (the New Ecological Paradigm, or NEP) after engineering students took an environmental studies course, and Karpudewan, Ismail and Roth (2012) also found increased NEP scores among pre-service teachers who completed a green chemistry curriculum as part of their degree in science teaching. Importantly, Brody and Ryu (2006) found a statistically significant decrease in ecological footprint among students who took a graduate course in sustainable development, but not in a control group of students enrolled in the same University who took a course unrelated to sustainability.

Environmentally-focused education does a number of things. It exposes students to relevant information. It frequently incorporates outdoor experiences. And at the university level, it can provide students with a social identity: a self-definition that is attached to group membership (Hegerty 2008; Stapleton 2015). Just as professionals develop a sense of themselves as doctors, journalists, or conservation scientists, students begin to think of themselves as biology majors or forestry students. Identities are formed through interactions with others, and the social interactions that occur within the classroom and in related extracurricular experiences, even more than the information that is conveyed, can help to foster a sense of belonging and shared values associated with the degree program. Huxster, Uribe-Zarain and Kempton (2015) found that environmental group membership was a stronger predictor of climate change knowledge than enrollment in a science major.

Hypotheses tested in this paper

This paper reports research designed to uncover the relationship among these different variables: childhood experiences, social experiences, current involvement with nature, and educational discipline, and how they related to environmental identity among French students. More specifically, we tested the following hypotheses:

- (1) Environmental identity (EID) is associated with academic education, personal experiences of nature and social identity. We anticipated that we would find disciplinary differences in environmental identity, such that those in disciplines related to the natural world would have higher environmental identity scores than those in math or political science. We also predicted that environmental identity would be associated with both current experiences with nature and a supportive social environment. Our question was whether academic discipline would be associated with environmental identity after the other influences were taken into account.
- (2) Environmental identity is associated with childhood upbringing. We expected a high EID to be associated with a more rural childhood upbringing because of the opportunity for regular contact with nature.
- (3) Environmental identity will differ according to gender. Research on the relationship between gender and environmental concern has fairly consistently shown slightly higher concern among women than men, with some exceptions (Gifford and Nilsson 2014). Research has been more equivocal on gender differences in EID, with Clayton (2003) reporting non-significant gender effects among U.S. students, but Clayton and Kiliñç (2013) finding that women scored significantly higher. Because some gender differences may be explained by occupation and professional interests, we thought it would be particularly important to see whether gender differences would persist when differences in the type of academic program were considered, which would suggest a more fundamental basis for the difference.

Material and methods

We administered a questionnaire survey to a convenience sample of 1126 French students during fall and winter 2012–2013. We chose the sampled students based on both academic curricula

Table 1. Survey sample (919 students).

Discipline	Grades	Number	Details
Political sciences	Undergraduate and graduate	231 (NGO: 14/Not-NGO: 217)	Grade 2: 1 class (72 women, 29 men) Grade 3: 1 class (21 women, 22 men) Grade 4: 1 class (21 women, 21 men) Grade 5: 3 classes (23 women, 19 men)
Maths	Undergraduate	26 (NGO: 1/Not-NGO: 25)	Grade 3: (7 women, 19 men)
Biology	Undergraduate	255 (NGO: 28/Not-NGO: 227)	Grade 2: 1 class (150 women, 58 men) Grade 3: 1 class (28 women, 19 men)
Ecology – technical school	Undergraduate	259 (NGO: 87/Not-NGO: 172)	Grade 1: 41 women, 84 men Grade 2: 37 women, 29 men Grade 1 and 2: 17 women, 51 men
Ecology – university	Graduate	143 (NGO: 61/Not-NGO: 82)	Grade 4: 57 women, 38 men Grade 5: 31 women, 17 men

(see later) and practical access to the students, which depended on instructors' willingness. The questionnaire was presented in a printed version to students in a teaching context by the instructor, at the beginning or at the end of a class session. It was presented as a study on the relations between personal relationships to nature and conservation issues, and whether these relations change during life and training.

The completion of the questionnaire was anonymous and voluntary. The completion of the questionnaire lasted between 5 and 10 min.

Sampling

The same questionnaire was passed to students from five different curricula (Table 1): political sciences, undergraduate maths, undergraduate biology with some courses in ecology, graduate specialization in ecology, and technical undergraduate school in ecology. Students in these curricula differed in levels (undergraduate and graduate), in the importance of ecology courses to their academic curricula, and in the presence of practical and technical courses in ecology (present in technical undergraduate schools and not in academic undergraduate and graduate). Thus the different curricula varied in their ecological emphasis.

Students from the academic curricula were sampled in the two large French metropolises of Paris and Montpellier, in large public universities. Students from the technical curricula (BTS GPN) were sampled in different public school located in small French cities and in the country side. Sampled academic and technical curricula are delivered in public school, which are almost free of charge in France (and in which fees are paid by the state for students with low income).

Questionnaire

The questionnaire was composed of three different parts (see Appendix 1):

- (1) *Environmental identity scale* (Clayton 2003), in the short version of 11 items proposed with a 7-level Likert scale. This part was presented as following: 'we would like to know your opinion on the following propositions.' The EID scale has been used in a number of settings around the world and has shown good internal reliability and convergent validity (Clayton 2012).
- (2) *Inclusion of nature in self* (INS, Schultz 2002), which is a mostly nonverbal measure of 7 sets of circles, varying in the degree of overlap, representing our relation to nature. This part was presented as following: 'please quote which figure is the best representation of your relationship with natural environment.' The INS has also been extensively used in research (Liefländer et al. 2013).

- (3) *Personal information* that could be linked with the individual environmental identity. The first item was a score of the rurality level of habitat during childhood (named 'childhood' in the following) assessed on a 5 level Likert-scale: large metropolis, medium town, small town, village, countryside. The second one assessed the frequency of current uses of natural areas (named 'nature use' in the following), on a 5 level Likert-scale: never, few times a year, once a month, once a week, and every day. The last two concerned social identity of the respondents in relation to environmental conservation: whether they were member of a nature protection association (NGO; yes or no); and the proportion of friends and relatives that are concerned by nature protection (named 'friends' in the following), assessed on a 5 level Likert-scale: nobody, less than 25%, from 25 to 50%, from 50 to 75%, more than 75%.
Current curriculum and grade level (that is, number of years in program)
Gender (male or female)

All the answers were scored in an Excel database. Out of the 1126 questionnaires, only 919 were completed with answers to all the questions of interest. We did all the analyzes based on these 919 questionnaires.

Statistical analyzes

We first studied the correlations between the three personal information items that are potentially linked to EID (i.e. 'childhood,' 'nature use,' 'friends') as well as the relationship with gender and NGO membership. We used Spearman's rank correlation when the variables were ordinal. We then tested a potential effect of gender and NGO on each variable with linear modeling and Anova tests.

After having tested the reliability of the 11 items of the Environmental Identity Scale (Cronbach $\alpha = 0.82$), we computed the Environmental Identity score of each respondent (EID) by summing the declared score in each item. EID scores were normally distributed.

Our sampling was composed of students asked in classes, in which we cannot assume the statistical independence of students. However, some samples in the categories of interest (i.e. disciplines, curriculum, and grades) were composed of several classes (see Table 1). Therefore, in order to test the effects of different independent variables on the EID score, we computed linear models with mixed effects, with classes as a random effects and variables of interest as fixed effects.

We proceeded the model selection based on the Akaike Information Criterium (AIC), and considered the best model as the one with the lowest AIC (two models were considered as significantly different when their AIC differed for more than 2 units). We then tested the effects of each remaining variable with Anova type III, which calculates the statistical importance of each variable as it was entered last, i.e. by taking into account the effects of the other variables implemented in the model. All quantitative variables were standardized before the step-wise analyzes.

We tested for specific indirect causal effects by mediation analyzes, using the Aroian version of the Sobel test (Baron and Kenny 1986).

We performed all the analyzes with R-software (R-Development-Core-Team 2010), packages *ade4*, *psych*, *nlme* and *bda*.

Results

Environmental identity (EID) and inclusion of nature in self (INS)

Respondents' scores for EID and INS were strongly and positively correlated ($\text{corr} = 0.63$, $p < 0.001$). Together with the strong reliability of the 11 items of EID scale (Cronbach $\alpha = 0.82$), the correlation between verbal and nonverbal measures let us feel confident about the French adaptation and accuracy of the EID scale to study individual connection to nature. In the following, we considered EID as the explaining variable because we were primarily focused on identity.

Correlations between personal variables

'Childhood,' 'Nature' and 'Friends' were significantly correlated with each other (Table 2). However, because they represent different parts of individual relation to nature (respectively personal history, individual behaviors and social identity, see introduction), we decided to test the respective effects of each item on the environmental identity in the sample of students.

Male students appeared to have spent their childhood in more urbanized areas than female students ($\beta = -0.12 \pm 0.06, p = 0.049$). However, we did not find any gender effect on the frequency of nature use ($p = 0.51$), nor on the proportion of friends and relatives that are concerned in conservation issues ($p = 0.71$).

Students who stated that they were a member of an environmental NGO appeared to go much more frequently to natural spaces than others ($\beta = 0.23 \pm 0.08, p = 0.004$), and to have a much higher proportion of friends and relatives that are concerned in conservation issues as well ($\beta = 0.38 \pm 0.09, p < 0.001$). However, we did not find any relation between NGO membership and rurality of the childhood habitat ($p = 0.68$).

Environmental identity, gender, individual and social connection to nature and curriculum

Based on the AIC, we compared models including all the six variables of interest and their interactions (Table 3). According to the best model, we found that all six variables did impact individual environmental identity of the students, in the following manner:

Among the sampled students with completed data, environmental identity was significantly higher for women than for men (Anova Type III, $\text{chisq} = 7.00, \text{df} = 1, p = 0.008$, Table 4). The EID score significantly increased with the self-declared frequency of using natural areas (Anova Type III, $\text{chisq} = 64.2, \text{df} = 1, p < 0.001$, Table 4, Figure 1a), as well as with the self-declared proportion of friends and relatives that are concerned with conservation issues (Anova Type III, $\text{chisq} = 56.1, \text{df} = 1, p < 0.001$, Table 4, Figure 1b). In addition, students who declared being a member of an environmental NGO had a significantly higher EID than the others (Anova Type III, $\text{chisq} = 22.08, \text{df} = 1, p < 0.001$, Table 4). This effect is however different for students from different curricula (interaction between curricula and NGO, $\text{chisq} = 14.57, \text{df} = 4, p = 0.006$).

All other variables being taken into account, having spent childhood in more rural habitats did not appear to be significant (based on AIC, Table 3). However, when taken alone, students who reported having spent their childhood in more rural habitat did have a significantly higher EID score (Figure 1c). Indeed, this effect appeared to be strongly mediated by the current frequentation of natural spaces (Aroian version Sobel test: $z = 7.42, p < 0.001$), and to a lesser extent by friends' environmental awareness (Sobel test: $z = 2.21, p = 0.03$) and by the NGO membership (Sobel test: $z = 1.98, p = 0.047$).

Finally, the EID score appeared to vary significantly with the curriculum: all these personal variables being taken into account, the environmental identity of sampled students still strongly differed between the curriculums they were engaged in (Anova Type III, $\text{chisq} = 24.58, \text{df} = 4, p < 0.001$, Figure 2). In general, the grade level of the students did not impact environmental identity of sampled students ($\Delta\text{AIC} = -2.63$ when this effect was removed). Moreover, whatever the curriculum, the environmental identity of students did not differ between grade level within the given curriculum (result not shown).

In order to understand our results in more details, we compared the personal profiles of individual connection to nature for students from the different curricula. We found that they differed in their

Table 2. Spearman's correlation coefficients between the three quantitative personal variables.

	Childhood	Friends	Nature
Childhood	1		
Friends	0.13**	1	
Nature	0.33**	0.24**	1

** $p < 0.0001$.

Table 3. model selection for EID as a function of individual variables.

N°	Model	AIC
1	Childhood+friends+nature+gender+NGO+curriculum+curriculum:childhood+curriculum:-friends+curriculum:nature+curriculum:gender+curriculum:NGO	2326.93
2	Childhood+friends+nature+gender+NGO+curriculum+curriculum:friends+curriculum:nature+curriculum:gender+curriculum:NGO	2313.14
3	Childhood+friends+nature+gender+NGO+curriculum+curriculum:nature+curriculum:gender+curriculum:NGO	2303.14
4	Childhood+friends+nature+gender+NGO+curriculum+curriculum:gender+curriculum:NGO	2300.93
5	Childhood+friends+nature+gender+NGO+curriculum+curriculum:NGO	2291.55
6	Childhood+friends+nature+gender+NGO+curriculum	2294.54
7	Friends+nature+gender+NGO+curriculum+curriculum:NGO/without 'childhood'	2284.92
8	Nature+gender+NGO+curriculum+curriculum:NGO/without 'friends'	2332.12
9	Friends+gender+NGO+curriculum+curriculum:NGO/without 'nature'	2339.92
10	Friends+nature+NGO+curriculum+curriculum:NGO/without 'gender'	2286.01
11	Friends+nature+gender+NGO/without curriculum nor interaction with NGO	2289.76

Note: The best model is indicated in bold.

Table 4. Summary of correlational effects between EID and individual variables, according to the best model.

Variables	β (standard error)	t-Value (df)	p-value
Gender (men)	-0.15 (0.06)	-2.65 (886)	0.008
Friends' awareness	0.21 (0.03)	7.49 (886)	<0.0001
Frequentation of natural areas	0.25 (0.03)	8.01 (886)	<0.0001
NGO membership	1.52 (0.60)	2.55 (886)	0.01

individual relations to nature, as following: Students from the five different curricula significantly differed in the rurality of their childhood habitat ($\chi^2 = 315.48$, $df = 16$, $p < 0.001$). More precisely, students in technical school grew up much more frequently than expected in rural habitats. Students from curricula in biology and maths came from a large metropolis more than would be expected according to the null hypothesis that there is no relationship between curriculum and upbringing.

Students from the five different curricula significantly differed also in their frequency of using natural areas ($\chi^2 = 220.64$, $df = 16$, $p < 0.001$). More precisely, students from technical school use natural areas much more frequently than expected according to the null hypothesis; on the contrary, students from political sciences use natural areas less frequently than expected.

Students from the five different curricula significantly differed in the environmental awareness of their friends and family ($\chi^2 = 55.06$, $df = 16$, $p < 0.001$). Students in political sciences are in social groups that are less concerned by environmental issues than expected according to the null hypothesis; this is the opposite for students in ecology.

Finally, students from the five different curricula differed in their involvement in environmental NGOs ($\text{chisq} = 116.07$, $df = 4$, $p < 0.001$). In particular, students in political sciences are much less involved in environmental NGOs than expected according to the null hypothesis, the opposite for students in ecology (both academic and technic, Figure 3).

Discussion

Our results allow us to validate most of our working hypotheses regarding environmental identity of the French young adult community we have sampled. Indeed, we found strong positive correlations between environmental identity, the degree of current experiences of nature, and current social identity regarding nature. The rurality of the childhood place significantly explained environmental identity, through both current experiences and social identity regarding nature. We found a higher environmental identity in young women than in young men, even when controlling for academic curriculum and other personal variables. Finally, students conducting different curricula significantly differed in

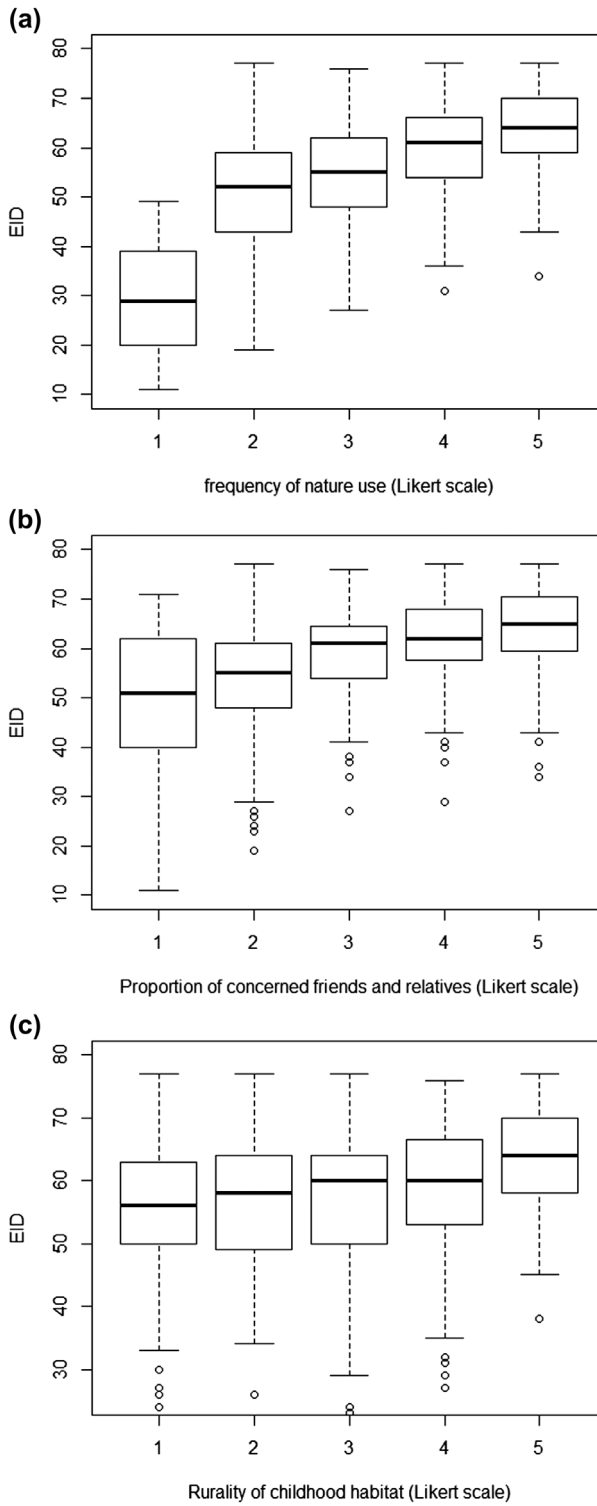


Figure 1. Boxplots between EID and the three individual variables of relations to nature. (a) Frequentation of natural areas rurality of childhood habitat. (b) Friends'and relatives' environmental awareness. (c) Rurality of the childhood habitat.

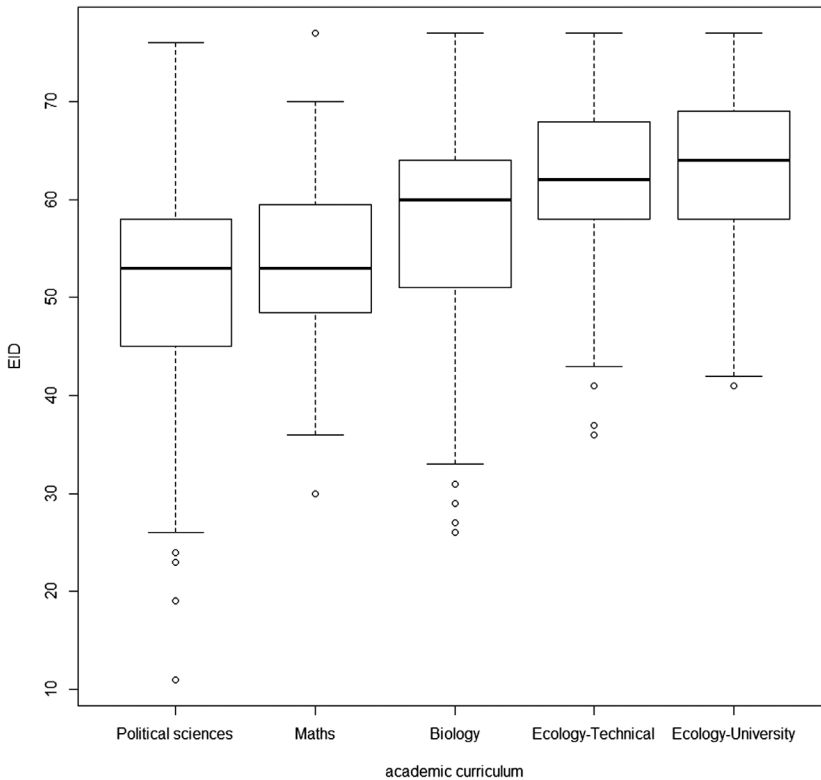


Figure 2. Environmental identity of students involved in the five studied academic curricula.

their environmental identity (e.g. students studying ecology had a higher score than students studying political science).

The gender difference in environmental identity is consistent with previous results in the literature. Further research should be conducted to confirm this tendency, but, as proposed by Gifford and Nilsson (2014), this may partly reflect the fact that gender roles encourage women to see themselves as caretakers, responsible for the health and wellbeing not only of their children but also of others and of the environment in general.

The strong positive correlation between rurality of childhood habitat and current environmental identity is consistent with already published hypotheses stating the importance of experiences of nature during childhood to explain individual involvement in conservation when adult (e.g. Chawla 1999). Here, we did not question directly the experiences of nature during childhood, but we only asked a factual question regarding their home. We are aware that living in rural area does not imply automatically spending time in nature. Indeed, there can be many confounding effects, such as income or parents' attitudes toward environment. However, small cities and villages in France provide much more protected and unprotected natural areas (i.e. parks and reserves vs. extensive farmlands and forests) in the close neighborhood than large metropolis (Depraz 2008; Mathevet and Godet 2015). Rural areas therefore provide more opportunities for children to make free outdoor activities and to experience nature, and further research should address whether these opportunities are really exploited by children.

Our results underline that the correlation between childhood environment and EID is mediated by adult behavior (visiting natural areas). It could be interpreted as childhood experiences create some kinds of habits or routine (e.g. having fun outdoor, going outside to relax) that remain in adult ways of life. The behavior here (visiting natural areas) then promotes higher scores of environmental identity in a virtuous cycle: previous experiences predict both identity and current behavior, and identity and

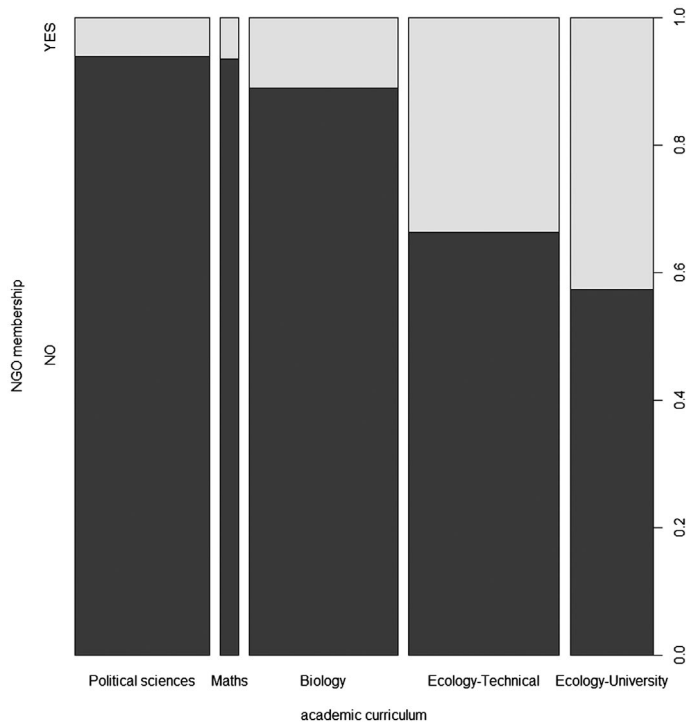


Figure 3. Respective proportions of NGO membership according of the five studied academic curricula.

current behavior reinforce each other. Adult behavior also includes interactions with friends, so the relationship between friends' environmental engagement and EID is important. A strong environmental identity can be difficult to maintain in the absence of social support (Zavestoski 2003). People who feel a sense of connection to the natural environment may be unable to maintain that connection if their primary social network does not also encourage environmental activities and pro-environmental attitudes. Notably, the choice of a degree program is also to some extent a choice of social context: it provides a specific group of peers with whom one is likely to interact.

Regarding the differences in EID between student curricula, our results showed that students in political sciences have the lowest level of environmental identity among all the sampled students. Yet, in France, most policy-makers and decision-makers come from academic curricula on political sciences. Besides technical and institutional constraints that may hinder local and national innovations, we propose that the low personal environmental identity of these stakeholders may partially explain why they are reluctant to enact more policies to protect the natural environment. It may be possible to include compensatory education in political science curricula. For example, Cuadrado et al. (2015) found that students studying environmental science made more pro-environmental decisions in an online farming simulation than did education students, but when students were primed with a cooperative mindset, the education students showed the same level of pro-environmental behavior as the environmental science students.

Because students from these different curricula also differ in their personal variables (childhood habitat, current experiences of nature, current social identity regarding nature), and because environmental identity did not increase with the class level within a given curriculum, the evidence does not support a causal impact of degree program on EID. Instead, we propose a reverse causal relationship between environmental identity and curriculum: young adults choose their academic curriculum partly according to their environmental identity, rather than the reverse. Having already developed a

stable identity, they are affirming their identities through their educational choices. We are aware that environmental identity is far from the only parameter that encourages individual intentions to act, but our finding is consistent with previous studies, stating that the curricula are more chosen regarding to previous feelings and disposition than the reverse (e.g. Arnocky and Stroink 2011). We showed that the proportions of students that are members of an environmental NGO strongly vary between curricula. We do not have information about the timing of their membership, but it sounds possible that students decided to join one of these NGOs after having entered specific curricula (e.g. ecology), due to their previous individual connectedness to nature, but also following the social norms (sensus Cialdini and Goldstein 2004) demonstrated in these curricula. Being part of a specific curriculum would contribute to building the social identity of the students, via NGO membership for instance.

Therefore, our results insist on the central roles of personal experiences of nature, social in-group, and childhood experiences of nature to increase individual environmental identity, more than formal education (at least at the academic level). Because environmental identity is a proxy for environmental-friendly behaviors (Clayton and Kilinç 2013), we face an urgent need to provide opportunities for children and adults to experience nature. These opportunities are already proposed by academic and nonacademic environmental education initiatives, and they are essential. However, the latter are not sufficient: first because they concern a minority of people, i.e. those that decide to participate and that are already concerned by these questions; and secondly because, whatever the openness of the educators, they tend to be limited to a socially constructed vision of nature and biodiversity, mostly based on conservationists' knowledge and expertise (Prévot, Servais, and Piron 2016). Instead, ecological place-based education (e.g. Gruenewald 2008) can help individuals integrate ecological, social and political issues together. More, being in nature in an informal way, alone or in interaction with other people, also provides opportunities to increase a sense of place (Korpela 2012), which has been proven to help individuals to build their own vision of what is good for the place. Although place attachment is a complex construct and does not necessarily lead to more pro-environmental behavior, those who are attached to the natural aspects of a specific place do demonstrate greater pro-environmental behavior (Scannell and Gifford 2010).

Our proposition of providing more opportunities for children to experience nature freely in their everyday lives means two different profound social changes. The first one concerns general postures and visions toward activities in nature: children today spend an increasing amount of time indoors compared to outdoors (e.g. Soga and Gaston 2016). In addition, independent and free play outdoors is sometimes not valued by parents or care-providers, for safety reasons (Valentine and McKendrick 1997), or for personal attitude regarding dirt or chaos (Copeland et al. 2012). Yet, according to the social learning theory (Bandura 1973, cited in McFarland, Zajicek, and Waliczek 2014), children learn to act in relation to what their peers and their reference adults do and think. Indeed, children whom parents are more related to nature tend to play more outside than the others (Hammond et al. 2011; McFarland, Zajicek, and Waliczek 2014). To break this vicious cycle which contributes to the extinction of experience (Pyle 2003; Soga and Gaston 2016), new social norms regarding outdoor activities must therefore be re-invented.

The second one concerns the real opportunities to be in nature, both for children and adults: with global urbanization, an increasing number of people live in cities (United-Nations 2011); for sustainability reasons, urban planners are encouraged to densify the cities, in order not to encroach rural and natural territory. In these densification projects, urban nature is therefore very often considered to be in competition with human housing (as in Paris metropolis, Fabre, Prévot, and Semal, 2016). However, besides increasing environmental identity, urban nature is crucial for human well-being and health, as well as to decrease the extinction of experience (Miller 2005). We therefore suggest that one of the responsibilities of national and local authorities and urban planners is to increase the place of nature in the cities, both by welcoming natural places (parks, gardens, sidewalks ...), but also and as importantly by allowing people to enter those spaces.

Study limitations

Because we explored environmental identity through comparative methods, we can only be speculative about causal effects. More research is necessary to explore the effects of education in the formation of the EID. This process may be better studied through longitudinal and in-depth case studies of groups of students and individuals within equivalent grade levels within each curriculum. This would be a useful avenue for future research, especially in light of the links between EID, childhood upbringing, environmental education at university, personal experiences of nature, and social identity.

Conclusion

Besides numerous external factors (e.g. political, contextual, economic), environmental psychologists have repeatedly shown that pro-environmental behavior is based on many different and complementary individual factors, including knowledge, personal experiences of nature, attitude, and perceived social norms, as well as identity. The results presented in this paper suggest that nature experiences play a prominent role in allowing nature to become a part of individual identity, and encouraging life trajectories (here the choice of an academic curriculum, and eventually a job). Encouraging and valuing personal and informal nature experiences appears therefore crucial to decrease nature deficit, especially in urban setting.

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Appendix 1. Questionnaire – Identité environnementale

Nous sommes un groupe de chercheurs en sciences sociales et biologie de la conservation, au CNRS, Muséum National d'Histoire Naturelle et Wooster College (Etats-Unis).

Nous cherchons à comprendre les liens que nous entretenons tous avec la nature et les enjeux de conservation, et comment ces liens peuvent évoluer au cours de la vie et des apprentissages.

Si vous en êtes d'accord, vous pouvez nous aider ! En remplissant le questionnaire suivant.

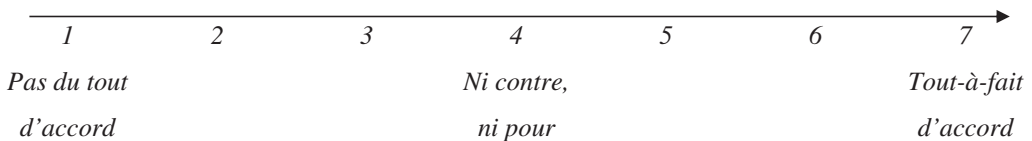
Ce questionnaire sera traité de façon anonyme

Nous vous remercions d'avance,

Raphaël Mathevet, Susan Clayton, Anne-Caroline Prévot

I. Nous souhaitons connaître votre avis sur les différents items suivants

Pour chacune des affirmations suivantes indiquez svp dans quelle proportion vous êtes en accord ou désaccord, sur une échelle allant de 1 à 7 (voir ci-dessous):



A. Je passe beaucoup de temps dans la nature (en forêt, à la montagne, près de la mer)

1 2 3 4 5 6 7

B. Je me sens faire partie de la nature, et non séparé(e) de celle-ci

1 2 3 4 5 6 7

C. Si j'avais assez de temps ou d'argent, j'en consacrerai certainement une partie à des causes environnementales

1 2 3 4 5 6 7

D. Quand je suis contrarié(e) ou stressé(e), je me sens mieux quand je passe du temps dehors, à «communiquer avec la nature»

1 2 3 4 5 6 7

E. Je sens que j'ai beaucoup de choses en commun avec d'autres espèces

1 2 3 4 5 6 7

F. Avoir un comportement responsable envers la terre – un style de vie soutenable- fait partie de mon code moral

1 2 3 4 5 6 7

G. Acquérir des connaissances sur la nature devrait être une part importante de l'éducation des enfants

1 2 3 4 5 6 7

H. Je préférerais vivre dans une petite chambre ou maison avec une belle vue, plutôt que dans une grande chambre ou maison avec comme vue d'autres bâtiments

1 2 3 4 5 6 7

I. Je considère qu'une partie importante de ma vie serait manquante si je ne pouvais pas sortir et profiter de la nature de temps en temps

1 2 3 4 5 6 7

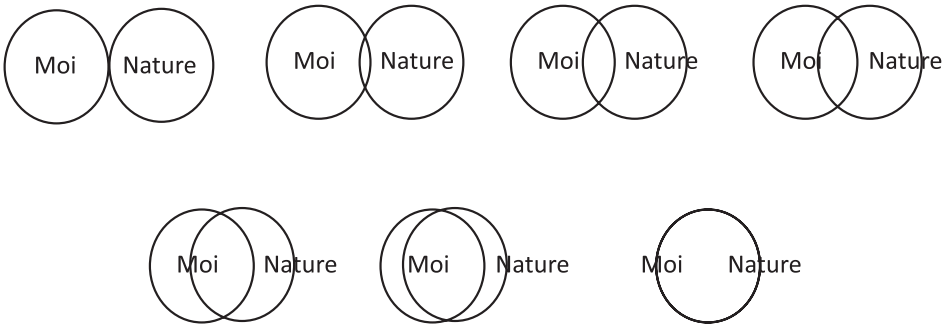
J. Je n'ai jamais vu aucun ouvrage ou œuvre d'art qui soit aussi magnifique que le travail de la nature, comme un coucher de soleil ou une montagne

1 2 3 4 5 6 7

K. Je sens que je reçois une nourriture spirituelle de la nature.

1 2 3 4 5 6 7

II. Pouvez-vous svp entourer une des figures ci-dessous, figure qui décrit le mieux votre relation à l'environnement naturel.



III. Merci de compléter svp. Le traitement restera anonyme**Année de naissance:** _____ **Nationalité:** _____**Sexe:** Garçon Fille**Où avez-vous passé l'essentiel de votre enfance ?**

Grande agglomération – ville moyenne – petite ville – village – hameau

Etes-vous membre d'une association de protection de la nature ? oui non**Quelle proportion de votre entourage (amis, famille) s'intéresse à la protection de la nature ?** aucune personne [0-25%] [25-50%] [50-75%] [75-100%]**A quelle fréquence fréquentez-vous un espace de nature ?** Jamais Quelques fois par an Une fois par mois Une fois par semaine Tous les jours**Dans quel espace de nature allez-vous le plus souvent ?** _____**Formation actuelle:****Formation antérieure:**

Ecologie Biologie

Sciences humaines: lesquelles ? _____

Autre: _____

Si vous avez étudié en dehors de France métropolitaine précisez svp (années, filières, ville, pays):

Merci de votre participation

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