

Impact of a university course on pre-service teachers' conceptions about environmental issues and environmental education

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ABSTRACT

The paper presents the results of the evaluation of a university environmental course on pre-service teachers' conceptions of environmental issues and environmental education. The evaluation method leaned on the theory of social representations and used stimulus terms to trigger respondents' ideas. The course had a positive effect on participants' conceptions, as it was indicated by the transformation of the conceptual framework for the stimulus terms. Our findings offered valuable insights for the proper transformation of the course while the easiness of the applied method in data collection, renders feasible the longitudinal monitoring of course effects.

KEYWORDS

Environmental education, environmental issues, social representations, word associations, environmental conceptions

RÉSUMÉ

Cet exposé présente les résultats de l'évaluation d'un cours environnemental universitaire sur les conceptions des instituteurs des questions environnementales et de l'éducation environnementale. La méthode de l'évaluation s'est appuyée sur la

théorie des représentations sociales et a utilisé des termes stimulants pour provoquer les idées des répondants. Le cours a transformé les conceptions des participants, comme cela s'était indiqué par la transformation du cadre conceptuel des termes stimulants. Les résultats ont offert des aperçus considérables de la transformation correcte du cours, pendant que la simplicité de la méthode suivie à la collection des données, rend réalisable le suivi longitudinal des effets du cours.

MOTS CLÉS

Éducation de l'environnement, problèmes environnementaux, représentations sociales, association de mots conceptions environnementales

INTRODUCTION

It is widely admitted that education should be approached as a process of changing conceptions of learners than just a process of transmission of knowledge (Abd-el-Khalick & Akerson, 2004). The current educational approach has been mainly become known under the umbrella of conceptual change in science education. It proceeds from the insight that learners bring their own conceptualizations of the natural world to the classroom which are usually incompatible with scientific ones (Georgiades, 2000; Hayes, Foster & Gadd, 2003; Venville, 2004). Purportedly, students are expected to replace and re-organize their central concepts within a teaching procedure which is viewing learning as a process of conceptual change (Carey, 2000; Macbeth, 2000; Merenluoto & Lehtinen, 2004). Moreover, it is argued that changes could not only concern the conception of the subject matter of a course, but also the general view of the world of the learner, or even attitudes towards education, or towards the importance of a learning curriculum and the way it should be taught (Wickman & Östman, 2002). It is stated, for instance, that educational discourse transmits conceptions of the world and of the place of human society in it (Korfiatis, Stamou & Paraskevopoulos, 2004). These conceptions form part of learners' worldview and affect their way of thinking and acting (Cobern, Gibson & Underwood, 1999).

Regarding courses on the environment, any teaching about the environment produces a view of nature and of human-nature relationships (Östman, 1998). This view influences individual behavior and the willingness to make adjustments in order to safeguard the environment (Storey & Oliveira, 2004). Understanding personal conceptions should help clarify some of the barriers that occur when trying to attain ecological sustainability on our planet (Jurin & Hutchinson, 2005). It has been argued, for instance, that most science curricula promote a worldview which is deeply mechanistic and reductionistic, and which offers the legislative background for exploitative behaviour

towards nature (Korfiatis, 2005). Environmental education is supposed to promote changes from a more technocratic and exploitative worldview to a more pro-environmental one (Korfiatis, 2005; Jurin & Hutchinson, 2005).

However, it is important to point out that recent studies suggest that it seems to exist a shift in people's environmental conceptions towards more environmentally friendly ones, or that "traditional" and "modern" ideas about the environment coexist in people's minds (van den Born, Lenders, Groot & Huijsan, 2001). For instance, Castro and Lima (2001) stated that "...the notion that the environment has to be preserved, is fragile, and is threatened by humankind, seems to have become normative or is on the way to becoming normative" (p. 418). Nevertheless, they argued that, acceptance of new 'ecological' ideas does not in every case mean the abandonment of the old 'exploitative' ones. For these researchers, the understanding of the way old and new ideas are combined in people's conceptualization of nature, and of human-nature relationships, may be the key to explain why some people are willing to change their pro-environmental behaviour, while others are not. In other words, Castro and Lima (2001) suggested that for the environmental movement in general, and environmental education in particular, the important question nowadays should be "why, although environmental issues have hit the public agenda, behavioural changes have not – or not to the same extent" (p. 401).

In a similar vein, Jurin and Hutchinson (2005) studied students' ecological worldviews and founded that the larger part of the sample expressed a worldview which compromised an acceptance of humankind's impact on the natural world with a desire to preserve their modern, consumeristic, lifestyle. Such a worldview could explain, according to the authors, why people may not be acting for the environment, despite their intentions. Research outcomes like those mentioned above have important implications for educational research, since they suggest that environmental education does not have to focus anymore on how it will increase people's environmental sensitiveness, but how it will help people with this perspective adopt a new environmental paradigm.

The method of teaching environmental matters is also a major point of concern for environmental educators. It is strongly argued that environmental education is not only about constructing ecological knowledge, but it has to do with attitudes, values and behaviour. It is also argued that education about environmental attitudes and behaviour should not have the form of propaganda, or forceful conversion to ecological values, but it should develop, at the same time, student's critical thinking and free will. It has been proposed that an integrated environmental education approach should include three components, known as "education about the environment", "education into the environment" and "education for the environment" (Palmer, 1999). "Education about the environment" stands for the cognitive aspect of education, i.e. construction of knowledge about natural systems and their function; "education into the

environment” promotes active types of learning favouring the direct experience with the subject of study, that is supposed to improve the attitudinal aims of environmental education, and “education for the environment” aims at empowering the wish for action for the environment. However, criticism has been raised concerning the fact that environmental education projects often deal more with the cognitive component, ignoring the others (Rickinson, 2001). From a totally different perspective, writers as Jickling (2003) and Chawla and Flanders Cushing (2007) pinpoint that many educational interventions trying to promote environmentally friendly attitudes and behaviour actually turn environmental education into indoctrination. In order to implement successful environmental education projects, all three components should be present, inter-linked and mutually supportive. Therefore the necessity for teachers and other potential environmental educators to be aware of the basic principles of environmental education is raised.

In the present study we examined students’ conceptions of environmental issues and environmental education before and after the attendance of an environmental science course at the Department of Education, University of Cyprus. We propose a word associations approach, motivated by the theory of social representations, as a method that may provide the necessary information for evaluating changes invoked by the learning procedure.

METHODS

Methodological background

The evaluation of a change invoked by an educational intervention usually focuses on the following issues (Hovardas & Korfiatis, 2006):

- Concepts’ richness: The number of concepts introduced in a conceptual structure is deemed crucial for the depth of conceptual change that has taken place (Pearsall, Skipper & Mintzes, 1997).
- Concepts’ validity: An important aspect in evaluating the changes invoked by a course is if the use of concepts is accompanied by their proper understanding (Duit & Treagust, 2003). In other words, it is not enough for somebody to mention the proper terms but we have to ensure that he/she attributes them the proper meaning, i.e. to ensure the validity of items in use (Venville, 2004).
- Structural coherence of the conceptual framework: For meaningful learning to occur an individual must possess a framework of relevant, domain-specific concepts to anchor the new knowledge (Pearsall et al., 1997). The more coherent is the developed structure, the more it guarantees the consistency of ideas and reasoning, the absence of contradictions and the interconnection of different concepts (Oliva, 2003). However, most studies imply the co-existence of multiple alternative

conceptions (Vosniadou, Ioannides, Dimitrakopoulou & Papademetriou, 2001; Lautrey & Mazens, 2004). Under a situation of co-existence of multiple conceptions it is often difficult to estimate if conceptual change has indeed occurred and how coherent the emergent structure is. Some researchers distinguish between central and peripheral elements of a conceptual structure, relating the kind of conceptual change to changes in the “core” of it (Carey, 2000; Abd-el-Khalick & Akerson, 2004): in the case of “assimilation”, the “nucleus” of a conception is not influenced, while “accommodation” involves radical changes in the “nucleus”. Implementing the Lakatosian concept of “hard core” in science education, Niaz (1998) suggested looking for students’ core beliefs as an appropriate starting point for a conceptual change teaching strategy.

- Availability of conceptual structures. It concerns the easiness to mobilize and retrieve ideas, as an indicator of the availability of the corresponding conceptual structure (Tsai & Huang, 2002).

Social representations’ theory in educational research

A social representation is defined as a structured mental construct shared by the members of a social group, allowing elaboration and communication of a social object; a social object could be any material or symbolic entity, to which people attribute certain characteristics and therefore are able to talk about (Moscovici, 1963, 2001; Marková, 2000; Miller, 2000). Within the above line of reasoning, a conception of a subject matter could be considered as a specific kind of social representation, while the teaching procedure could be held as a type of social discourse aiming at transforming particular social representations.

The social representation theory provides the theoretical justification for considering changes at the level of a learners group’s collective representation(s), thus avoiding the difficulties derived from focusing on idiosyncratic individual cases (Jones, Carter & Rua, 2000), capturing at the same time the variability expressed within a group. That approach exhibits certain theoretical and technical advantages that we have tried to demonstrate in the present study.

Social representations’ theory shares a series of crucial theoretical and methodological principles with current educational research: it makes use of a constructivist view of conceptual structures (Wagner, 1998); it is concerned with cognitive mechanisms that are activated in order to render unfamiliar ideas familiar (Jovchelovitch, 1995; Duit, Roth, Komorek & Wilbers, 2001); it builds on the incompatibility, on one hand, and the coexistence, on the other, of alternative conceptions within conceptual structures (Tyson, Venville, Harrison & Treagust, 1997; Vosniadou et al., 2001; Hovardas & Stamou, 2006); cognitive conflict is accepted as a method to increase cognitive activity (Koskinas, Papastamou, Mantoglou, Prodromitis & Alexias, 2000; Limón, 2001).

Finally, social representations' theory states that the alteration of a representation's core is crucial for studying the dynamics of conceptual structures; indeed, it is only when changes in the core can be traced that one can have a social representation transformed (Wagner, Valencia & Elejabarrieta, 1996). Yet, educational researchers have shown negligible interest in social representations theory (Kuhn & Lao, 1998; Miller, 2000). This may have more to do with the theoretical and methodological traditions within which each discipline has approached its subject rather than with any intrinsic incompatibility between the characteristics of educational and social research (Kuhn & Lao, 1998).

Word associations

Word associations is one of the methods used for the evaluation of conceptual structures, as well as for ascertaining belief or attitude changes in psychology and sociology (Doise, Clémence & Lorenzi-Cioldi, 1993; Schmitt, 1998; Hirsh & Tree, 2001; Ross, 2003). The method is based on the assumption that giving a stimulus word and asking the respondent to freely associate what ideas come to his or her mind provides relatively unrestricted access to mental representations of the stimulus term. It has been declared that ideas expressed within a word association procedure are spontaneous productions subject to fewer constraints than typically imposed in interviews or closed questionnaires, allowing thus the extraction of less biased results (Wagner et al., 1996).

The course: teaching pre-service teachers about environmental issues

The specific course, named "Environmental Issues", aimed at promoting awareness about global environmental issues (greenhouse effect, resources consumption, biodiversity reduction), as well as about the most crucial local problems (e.g. water insufficiency, tourism development, forest fires).

We would like to emphasize that the course's aim was not of a normative character, i.e. it did not intend to promote positive environmental attitudes. It aimed at a) the promotion of understanding of the complexity of human-nature relationships, b) the awareness of the existence of different approaches and opinions on the causes and the effects of an environmental problem, as well as different options for its solution, and finally c) empowerment of critical and creative thinking.

To achieve its aim the course did not follow a conventional context of lectures, but it rather adopted alternative ways of learning, such as writing of short reports by the students, role playing, debate events and experimental inquiry projects. Within this context we considered important for the evaluation of the course to depict changes in students' conception of the subject matter of the course (i.e. environmental issues), as well of environmental education, in general.

To capture students' conceptions on both above issues we use the stimulus terms "environmental issues" and "environmental education"

Sample and data collection

Respondents were recruited among students of the Department of Education of the University of Cyprus attending the course "Environmental Issues", which was taken during the third semester of their studies. The tutor of the course was the first writer of the present article. Respondents were asked to complete a word association task right before, as well as one month after, the attendance of the course. The duration between tests ought to guarantee the preclusion of carry-over effects. Participation in the study was voluntary, anonymous, and no mark bonus was assigned. Fifty-two students who attended the course participated in the study. Students were asked to list the first 10 words that came to their mind, for each one of the stimulus words "environmental issues" and "environmental education" (requiring multiple responses is said to capture the richness of a subject's association network, Schmitt, 1998). Each stimulus word was placed on an instrument with 10 blanks attached. Stimulus words appeared in random order. On average, respondents needed approximately 5 minutes to complete the task.

Data analysis

Data analysis was executed in three stages: (a) the first stage involved content analysis of word associations. This allowed us to delineate the richness of the word association reservoir for each stimulus term. (b) The second stage of data analysis was the structural reconstruction of word associations, which resulted in determining structural changes in the conceptual representation for each stimulus term. (c) The third stage of data analysis involved the narrative reconstruction of word associations, which aimed at examining relations of meaning affinity among associated words.

Content analysis

Associations were initially condensed by combining words at level I of the Bauer and Nation (1993) morphological hierarchy. Association types revealed included any base word and its inflections (e.g. "nature" and "natural"). This was done because these words should all have the same underlying meaning and therefore the same association. Associations given for each stimulus word were classified, according to their content, to five references categories: the "naturalistic references" category, which included associations referred to natural elements; the "human-impact references" category which included associations denoting human impacts on the environment; a category with "attitudinal references"; an "action references" category including associations denoting action for the environment and a "educational references" category includ-

ing references to educational concepts and processes. Fields of classification were derived both deductively (i.e. findings expected according to literature) and inductively, according to the empirical data of the present research (Titscher, Meyer, Wodak & Vetter, 2000; Korfiatis, Stamou & Paraskevopoulos, 2004). Inter-coder reliability between both authors amounted to almost 95%.

Structural reconstruction

A conceptual structure comprises of central as well as peripheral elements (Wagner, 1998; Carey, 2000; Lautrey & Mazens, 2004). The core is considered the conservative component that determines the organizational principle of the whole structure, and the periphery is the flexible component that helps the structure adapt to different frames of reference (Liu, 2004). The structural reconstruction initially involved the calculation of the frequency and the mean rank order of appearance for each association (Koskinas et al., 2000). The frequency is equal to the number of associations given per 100 associated words. Only associations with frequency higher than 1 were used for the analysis. Since 10 associations were requested per stimulus word, mean rank order of appearance had a minimum value of 1 and an upper limit of 10. Using the median value for both the frequency and the rank of each association, one can obtain four groups of associations: a high frequency/high rank group that is said to comprise the core of the representation, a low frequency/low rank group that is said to correspond to the periphery, and two diffusion groups (high frequency/low rank and low frequency/high rank, respectively), which are considered to occupy an intermediate position between the core and the periphery (Flament, 1989; Abric, 1993).

Narrative reconstruction

While structural reconstruction aimed at revealing patterns of respondents' conceptual schemata, narrative reconstruction aimed at revealing interrelations between associations for each stimulus term. Associations were subjected to hierarchical cluster analysis to determine recordings that tend to be given at the same time (Ross, 2003). Associations were aggregated into dendrograms, where actual distances were rescaled to numbers between 0 and 25. The smaller the distance that corresponds to the linkage point between two associations, the higher the corresponding degree of affinity. Thus, cluster analysis allowed us to explore if the affiliated words form meaningful groups, i.e. if they reflect a coherent conception of the stimulus term. In that sense, narrative reconstruction allowed us to evaluate the coherence of the words' reservoir used by the respondents. To make use of the entire word reservoir of each stimulus term, dendrograms were constructed by the average linkage between groups method.

RESULTS

Environmental issues

The participants used 27 associations before and 25 associations after the course referring to “environmental issues”. The average number of associations per student increased slightly after the course (Table 1).

TABLE 1. *Number of associations per student before and after the course*

Stimulus terms	Before the course	After the course
Environmental issues	8.37	8.87
Environmental education	8.17	6.17

Nine of the associations were introduced after the course. These changes are mainly due to the elimination of half of the naturalistic terms and the introduction of educational and human impact references (Table 2).

TABLE 2. *Content analysis of word associations*

Stimulus terms	Naturalistic references	Human-impact references	Attitudinal references	Action references	Educational references
Environmental issues	nature trees sea plants environment ground water air atmosphere animals soil forests organisms land vegetation green insects life clouds oxygen rain	infection pollution ozone greenhouse acid rain energy destruction human carbon dioxide eutrophication	awareness		course experiments element cycles ecology

Stimulus terms	Naturalistic references	Human-impact references	Attitudinal references	Action references	Educational references
Environmental education	<i>nature</i> environment		sensitization awareness respect love interest cleanness inadequate important necessary	protection recycling	learning school knowledge course information ecology edification seminars internet element cycles energy projects experiments

Note: Associations in *italics* did not remain after the course, while associations in **bold** were given after the course.

The frequency of the associations “nature” and “infection” was dramatically reduced, while the frequency of associations denoting human impacts (e.g. “acid rain”, “greenhouse effect”), as well as of the associations denoting the particular elements of nature that are affected (e.g. “atmosphere”, “water”, “ground” – Table 3) increased. The decrease of the use of the word “infection” is most possibly due to the realization that the term was mistakenly used in most of the cases instead of the correct “pollution”.

TABLE 3. Frequency and rank of words associated with the stimulus term ‘environmental issues’

Associations	Frequency		Rank	
	Before the course	After the course	Before the course	After the course
nature	38.46	16.67	2.20	3.89
infection	38.46	14.81	5.05	5.00
pollution	34.62	50.00	5.11	5.15
ozone	32.69	35.19	4.18	4.26
greenhouse	26.92	68.52	3.57	3.19
trees	23.08	9.26	4.42	4.67
acid rain	23.08	53.70	5.17	3.76
sea	23.08	9.26	5.17	8.00
ecology	21.15	20.37	3.00	3.36
plants	21.15	9.26	5.91	7.60
environment	19.23	31.48	2.50	1.53

Associations	Frequency		Rank	
	Before the course	After the course	Before the course	After the course
ground	13.46	44.44	4.29	5.08
energy	13.46	9.26	7.14	5.40
water	11.54	27.78	4.83	5.33
air	11.54	9.26	5.17	5.80
atmosphere	9.62	18.52	5.00	6.10
animals	32.69	-	5.41	-
soil	17.31	-	3.22	-
destruction	17.31	-	5.00	-
forests	15.38	-	2.75	-
organisms	13.46	-	5.43	-
land	11.54	-	3.17	-
human	11.54	-	4.67	-
vegetation	9.62	-	3.20	-
green	9.62	-	5.80	-
insects	9.62	-	6.20	-
life	9.62	-	7.60	-
element cycles	-	24.07	-	5.15
carbon dioxide	-	24.07	-	5.38
clouds	-	18.52	-	6.10
oxygen	-	18.52	-	6.90
awareness	-	16.67	-	4.00
course	-	11.11	-	1.67
experiments	-	11.11	-	7.67
eutrophication	-	9.26	-	5.40
rain	-	9.26	-	7.20

The core of the representation contained, before the course, two items referring to human impact on the environment (“greenhouse”, “ozone”), four items referring to nature (“nature”, “environment”, “trees”, “ground”) and the term “ecology” (Figure 1).

After the course, the terms denoting human impacts were enriched by the terms “pollution” and “acid rain”, while the references to nature were reduced and the term “awareness”, appeared in the place of the term “ecology”, which moved to one of the diffusion groups. Based on the changes depicted in the core of the conceptual structure, we could argue that the course enforced the awareness for the human impact on the environment.

Many of the terms introduced after the course were found in all the compartments of the conceptual structure, and were related to the greenhouse effect and to the water cycle. It is implied that the course reinforced both the above mentioned knowledge topics. Indeed, the narrative reconstruction (Figure 2), showed that before the course associations formed clusters of reference to environmental elements, mainly on the large scale of environmental megastructures (e.g. cluster of terms “life”, “green”, “atmosphere”,

FIGURE 1

Core, diffusion, and peripheral associations' groups for the stimulus term 'environmental issues' before (A) and after (B) the course.

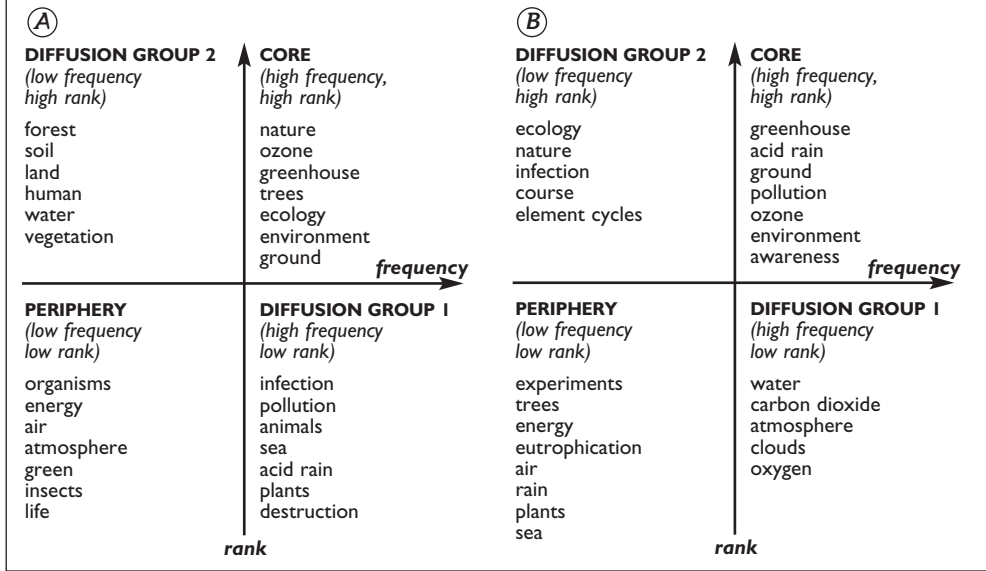
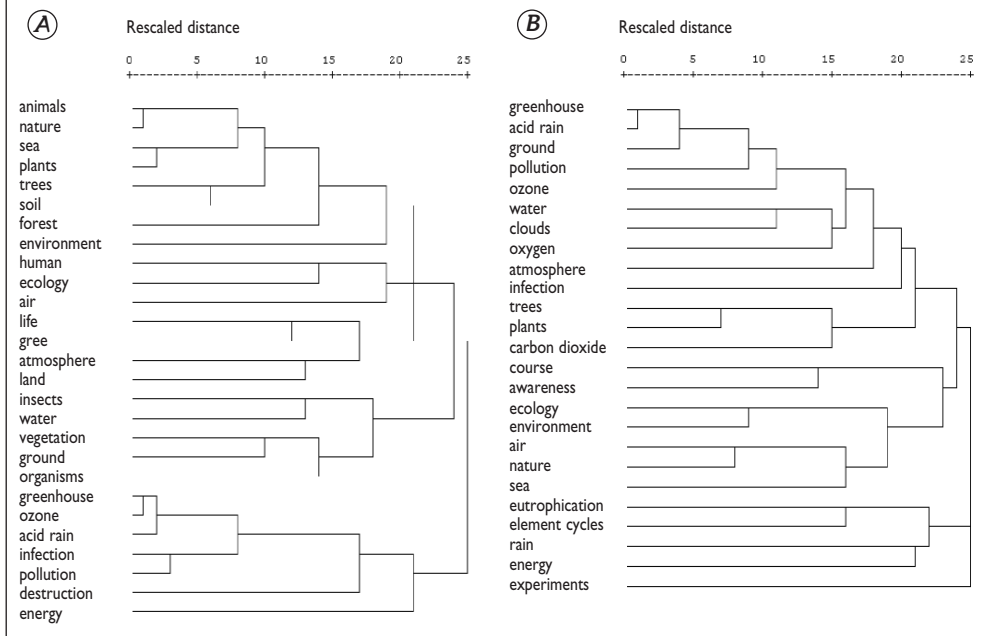


FIGURE 2

Relations of consistency between words associated with the stimulus term 'environmental issues' before (A) and after (B) the course.



“land”, or cluster of terms “animals”, “nature”, “sea”, “plants”). After the course, a cluster of associations showing disturbance of the ecosystem functions due to human impacts prevailed (cluster of terms “pollution”, “ozone”, “acid rain”, “ground”, “greenhouse”). A small cluster with the terms “eutrophication” and “elements cycle” can be considered as a result of the teaching procedure which approached the phenomenon of eutrophication as a disturbance of the nitrogen and the phosphorus cycle. It is also worth mentioning that the terms “course” and “awareness” were affiliated in one cluster.

Environmental education

The 20 associations used before the course were reduced to 16 after that. Six of them were new (Table 4).

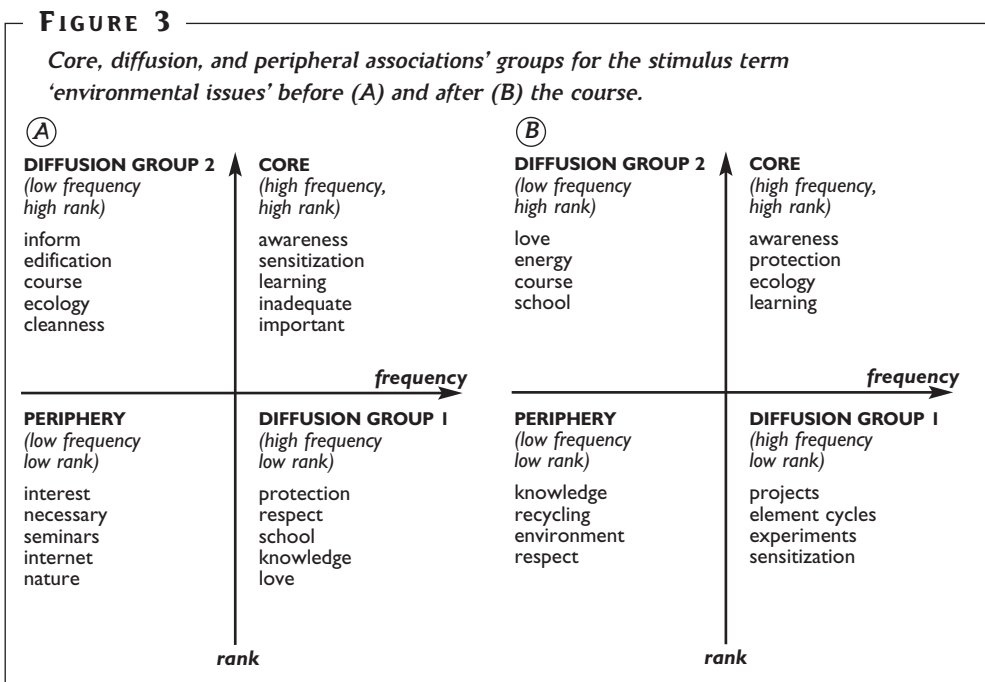
The average number of associations per student also decreased after the course (Table 1). Changes concerned mostly the “attitudinal” associations where the charac-

TABLE 4. *Frequency and rank of words associated with the stimulus term ‘environmental education’*

Associations	Frequency		Rank	
	Before the course	After the course	Before the course	After the course
awareness	48.08	46.30	3.75	2.56
sensitization	38.46	14.81	4.20	3.71
protection	30.77	35.19	3.63	3.74
learning	30.77	12.96	4.27	3.43
respect	28.85	9.26	4.67	5.00
school	25.00	11.11	5.54	1.33
knowledge	23.08	12.96	5.25	3.88
love	15.38	12.96	7.00	4.86
course	11.54	11.11	3.83	3.00
ecology	11.54	16.67	4.17	2.67
interest	15.38	-	3.08	-
inadequate	15.38	-	3.88	-
important	13.46	-	2.71	-
inform	13.46	-	5.43	-
edification	11.54	-	3.67	-
seminars	11.54	-	5.14	-
necessary	11.54	-	6.17	-
cleanness	9.62	-	3.40	-
internet	9.62	-	6.00	-
nature	9.62	-	6.40	-
projects	-	25.93	-	5.86
element cycles	-	24.07	-	4.31
experiments	-	18.52	-	5.40
recycling	-	14.81	-	4.75
energy	-	11.11	-	2.67
environment	-	11.11	-	5.50

terizations attributed to environmental education were eliminated after the course (e.g. “inadequate”, “necessary”), and the “educational references” category, where terms referring to getting information about the environment (e.g. “seminars”, “internet”, “edification”), were substituted after the course with associations denoting specific cognitive concepts and processes (e.g. energy, experiments, elements cycle).

The core of the representation for the stimulus term “environmental education” before the course implies a process of “learning” having to do with attitudes towards the environment (“awareness”, “sensitization”), characterized by the respondents as “necessary” but “inadequate” (Figure 3).

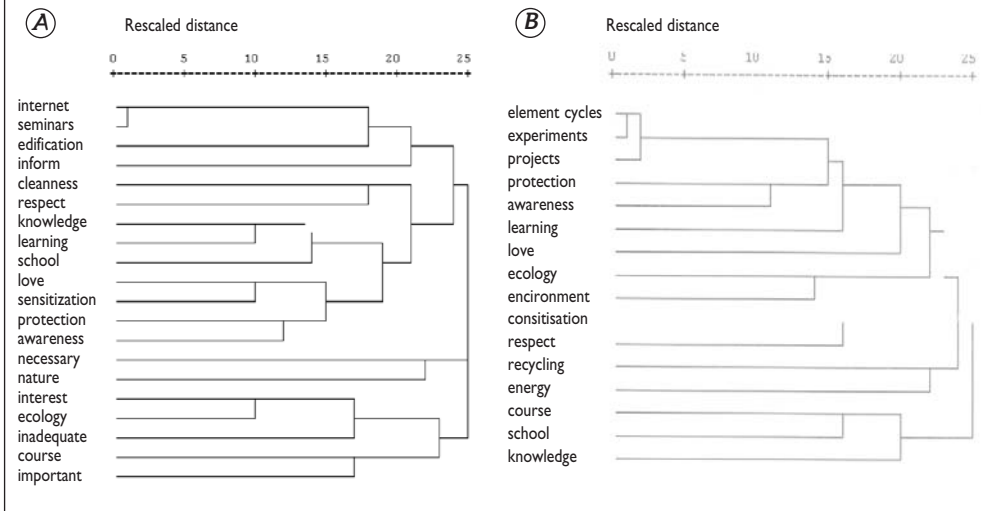


Attitudinal terms appeared in the diffusion groups as well (“respect”, “love”), however what prevailed is the image of environmental education as a process of getting knowledge and information about environmental matters (terms “school”, “courses”, “internet”, “seminars” etc.). Changes were extensive after the course, since in the core of the conceptual structure the terms “awareness” and “learning” were placed together with science (“ecology”) and action-oriented term (“protection”). Reference to environmental education as a learning process was also enriched by concepts of active learning such as “experiments” and “projects” and bits of important knowledge such as the “elements cycle”.

The narrative reconstruction was in line with the above picture (Figure 4): it

FIGURE 4

Relations of consistency between words associated with the stimulus term 'environmental education' before (A) and after (B) the course



revealed that, after the course, the new knowledge parameters (experiments, projects, elements cycles), formed a big cluster with attitudinal elements (“awareness”, “consciousness”), “learning” and action-oriented terms (“protection”).

DISCUSSION

The course transformed participants' conception for environmental issues and environmental education: this is indicated by the many changes in the associations used after the course, as well as the changes in the frequency and the order of appearance of the associations and the structural and the narrative transformation of the conceptual framework for both stimulus terms.

Specifically for the stimulus term “environmental education”, its representation integrated after the course cognitive (i.e terms “ecology”, “elements cycles” etc) with attitudinal (e.g. term “consciousness”) and behavioural elements (.e.g. term “protection”), as it was shown mainly by the cluster analysis. The structural reconstruction further confirmed that respondents, by selecting one term by each “category” for the core of the structure, declared that “environmental education” is a learning process comprised by a cognitive, an attitudinal and a behaviourist sector. Moreover, the cluster of the terms “experiments”, “projects”, “elements cycles”, together with the terms “protection”, “awareness” and “learning”, indicated that participants associated environmental education with constructivist forms of learning (e.g. projects or experiments), and not as with a passive process of acquiring information: it is relevant here

that the more “neutral” and in a sense more “traditional” terms “course”, “school” and “knowledge” formed a different cluster with no association with environmental terms. Our results allowed us to conclude that the conception of environmental education that students got within the course was close to the course’s objective. It should be mentioned that the course did not include any modules on principles and methods of environmental education. This is to say that the associations used by the participants to describe environmental education was not transmitted in a passive way during the course, but they describe the conception that was developed by students themselves, depicting the methods and the educational processes implemented during the course.

The course enriched participants’ conception of environmental issues as issues relevant with human-nature relationships. However, it turned out that it emphasized the destructive aspect of that relationship, since terms like “pollution”, “acid rain”, “ozone” are abundant after the course. The tutor’s aim was that the course could help students to equally develop an understanding on the possibilities of humans to adopt more sustainable forms of co-existence with the rest of the natural world, since it gave emphasis on aspects like environmental management, clean technologies or sustainable use of resources. Although the terms “awareness” and “protection” improved their status in the conceptual framework of the stimulus terms, we would expect more relevant associations indicating the potentiality of humans to act not only as destructors but as stewards of nature as well, to appear. It is obvious that the relevant modules did not fully reach their objectives and this is an aspect that we will try to improve in future implementations of the course.

Overall, results offered valuable insight for the proper revision of the course, while the easiness of the applied method in collecting the data renders the longitudinal monitoring of course effects on students’ conceptions feasible. The applied methodology, combining a word association technique together with analysis of the structure and the coherence of the conceptual framework, succeeded in providing valuable information about the effect of the course on learners’ worldviews.

Our methodology contributes in addressing a series of assumptions that frequently cultivate a tension between quantitative and qualitative methods. Quantitative methods are often accused of transforming interview accounts, rich in semantic content, into mere numbers, percentages, and levels of statistical significance. In both our structural and narrative reconstruction, word associations continue to carry their symbolic weight all along the statistical processing. On the other hand, qualitative methods may suffer with regards to the generalization of results. Our methodology may be effective in maintaining the strengths of both quantitative and qualitative methods and, at the same time, overcoming their most significant weaknesses.

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