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Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students

Ágnes Zsóka*, Zsuzsanna Marjainé Szerényi, Anna Széchy, Tamás Kocsis

Corvinus University of Budapest, Fővám tér 8, 1027 Budapest, Hungary

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ABSTRACT

Environmental education is assumed to have a significant influence on the environmental awareness, everyday lifestyles and consumer behavior of students. Several higher education institutions have recently recognized the importance of integrating sustainability issues into education to make this impact focused and explicit. This paper explores the relationship strength between environmental education and environmental knowledge, attitudes and reported actual behavior of university and high school students, providing a comparative questionnaire survey analysis which is unique in the literature. The results show a strong correlation between the intensity of environmental education and the environmental knowledge of students. This is partly due to the environmental education itself and partly due to the higher intrinsic motivation of committed students who voluntarily participate in environmental education, primarily at university level. The focus of the environmental education appears to be important in shaping attitudes about sustainable consumption. Addressing the issue of consumerism in environmental education clearly increases awareness of the need for consumption-related lifestyle changes. Based on Multidimensional Scaling methodology, the interdependence of several influencing variables is explored and illustrated graphically. Respondents are classified into five clusters – hedonist, techno-optimist, active environmentalist, familiar and careless – according to their environmental knowledge, attitudes, consumer behavior and everyday environmental awareness. Consistencies and inconsistencies in behavior are then identified in order to promote the creation of more effective educational instruments for supporting sustainable consumption and lifestyles.

1. Introduction

Today's students will have a major influence on the future state of the environment which makes the incorporation and institutionalization of sustainability issues into education highly relevant (see Lozano, 2006; Wright, 2007; Waas et al., 2010; Zilahy and Huisingh, 2009). The challenge for universities is high: the integration of different perspectives and the concept of sustainability makes systemic and holistic thinking and radically innovative ways of education necessary (Svanström et al., 2008; Lozano, 2006). The importance of understanding the attitudes and behavior of students towards the environment and of finding effective ways to influence this behavior through education is thus beyond dispute. In Hungary, little research has so far dealt specifically with the environmental consciousness and consumption habits of students. To address this knowledge gap, two surveys were conducted to capture information about:

(1) what today's Hungarian students, of differing ages, influenced by the different characteristics of environmental education, think and know about environmental issues (see Asunta, 2004; Kagawa, 2007; Michalos et al., 2009);
(2) how students view the relationship between the state of the environment and consumer lifestyles (see Benn, 2004; Worsley and Skrzypiec, 1998);
(3) how students actually behave and what determines their willingness to act in a pro-environmental way (see Boyes et al., 2008 and Kagawa, 2007).

The two surveys were executed in Autumn 2009 and Spring 2010 and were designed to elicit and allow comparison of the

* Corresponding author. Tel.: +36 1 482 5063.
E-mail address: agnes.zsoka@uni-corvinus.hu (Á. Zsóka).

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opinions of university and high school students (here the term '*university students*' covers both university and college students of 18–24 years of age, while '*high school students*' refers to 14–18 year old students from various types of high schools[1]).

The main assumption behind the research was that the intensity of involvement in environmental education is a significant factor in the formation of students' opinions and behavior regarding environmental issues (see Álvarez Suárez and Vega Marcote, 2010; Wright, 2007, Svanström et al., 2008; Lukman et al., 2013; Lozano, 2006 as well as Zilahy and Huisingh, 2009). Hence, the interrelationships between environmental education and environmental knowledge, attitudes and behavior were examined in the paper.

2. Literature about the environmental awareness of students and its relation to environmental education

2.1. Determinants of students' environmental awareness

Generally, the most important dimensions of an individual's environmental awareness appear to be environmental knowledge, values, attitudes, willingness to act and actual behaviors (Ajzen, 1985; Nemcsicsné Zsóka, 2008; Luthans, 2006) which are influenced by several factors including intentional and situational elements. Based on a profound value system, knowledge and attitudes are crucial because of their potential impact on behavior (although Csutora (2012) states that even positive, pro-environmental behavior does not guarantee a low environmental impact).

'*Environmental knowledge*' is a term used to mean knowledge and awareness about environmental problems and possible solutions to those problems. An increase in knowledge about environmental problems may raise peoples' concern and awareness however, it does not necessarily result in behavioral changes, (Kollmuss and Agyeman, 2002; Bamberg and Möser, 2007). '*Attitudes*' (being related to concrete situations and objects, positively or negatively, with special intensity and relevance (Rokeach, 1968)) were assessed in relation to environmental education, environmentally-aware lifestyles, consumption habits and different solutions to environmental problems. Changes in attitudes and values are necessary drivers for action, but are insufficient to alter behavior in a predictable way (Arbuthnott, 2009; Marjainé et al., 2011).

Environmental knowledge and pro-environmental attitudes are highly interconnected; according to Bamberg (2003) they strengthen each other, especially in information-seeking about environmental issues. Regarding the environmental knowledge of students, Asunta (2004) observed in her survey of 13–15 year old Finnish and German students that the number of sources students use to gather information about the environment increases with the students' class grade. Michalos et al. (2009) compared pro-environmental and sustainable behaviors across a sample of Canadian adults and students aged 10–18. For adults, having a favorable attitude towards the environment and sustainable development was a far more important determinant of behavior than knowledge about these issues (Kagawa, 2007 also found the same for university students), but for high school students the importance of knowledge and attitudes as behavioral drivers was about equal.

In addition to *internal factors* which are reflected in knowledge, attitudes and values, several *external factors* are also known to influence pro-environmental behavior. According to Fliegenschnee and Schelakovsky (1998), these account for 80% of an individual's environmental awareness. Important among these are norms, pressures and traditions transmitted by the social environment (Ajzen, 1985; Widegren, 1998). The behavior of students proves to be most strongly shaped by stimuli arising from the immediate environment (Lukman et al., 2013; Asunta, 2004), including family, friends, neighbors and education. Another key set of external factors are related to the environmental behavior in question, namely the availability of options and infrastructure, as well as the degree of sacrifice entailed (Hines et al., 1986; Stern, 2000; Arbuthnott, 2009). Kagawa (2007) found that students were most likely to undertake 'light green' activities (like recycling, saving energy and water, using public transportation and buying organic, fair trade and healthy products) which required minor changes in lifestyle. Boyes et al. (2008) compared the perceived utility of specific activities undertaken to mitigate climate change with Australian secondary students' willingness to carry out these actions. They found that willingness to engage in certain behaviors often exceeded the perceived climate benefits of those behaviors. Typical activities which required little effort and inconvenience (such as switching off unused electrical appliances and recycling) were most frequently undertaken. However, students were generally unwilling to give up traveling by car, although this was seen as being highly influential at preventing climate change. Respondents also expressed a reluctance to vote for political solutions such as increased environmental taxation and stricter environmental regulations, despite the perceived effectiveness of such changes. In their conclusion, Boyes et al. (2008) state that environmental education has the highest potential for fostering behavioral change with activities (such as eating less meat or paying more for renewable electricity) where students have an (originally low) willingness to engage, but where willingness steeply increases along with the perceived utility of the action.

Obviously, environmental education may impact students' pro-environmental behavior in several ways, including the transfer of knowledge and values, as well as providing examples and shaping the school as a social setting. The cited research findings also show that *interest* in environmental topics and *commitment* to them is crucial in determining the relationship between environmental knowledge and pro-environmental behavior. This suggests that the new challenge for environmental education is to effectively go beyond the role of simply transferring knowledge (see Section 2.3).

2.2. Perceived role of technological development and modest consumer behavior in tackling environmental problems

A crucial issue today is whether society can rely solely on technological progress and increasing eco-efficiency to achieve environmental sustainability (see Jänicke, 2008 for a discussion of the ecological modernization paradigm), or whether structural solutions involving a reduction in personal consumption and economic growth are inevitable (Rees, 2010; Sneddon et al., 2006; Waas et al., 2011). Based on mind maps drawn up for Danish students (aged 12–19 years) to represent present and future consumption, Benn (2004) found that students widely believed that technological development would be adequate to deal with environmental problems in the future and consumption would only be restricted by financial limitations. In contrast, less than 20% of Australian senior secondary school students, surveyed by Worsley and Skrzypiec (1998) held similarly optimistic views about technology, but this does not mean that they were correspondingly willing to reduce their consumption. Boyes et al. (2008) found that

[1] As the terms 'high school' and 'secondary' students may refer to different age categories in school systems around the world, in the literature review we use the original categories intended by the authors of cited papers.

not only is the willingness of teenagers to reduce personal consumption limited, but their awareness about the utility of such sacrifices is also low. In Kagawa's research (2007), university students tended to agree with radical statements about environmental issues but refused to make radical changes in their personal lives or at community and societal levels. The need to maintain economic growth as a goal was not questioned.

The failure to make the connection between consumerism and environmental problems is often attributed to the weakness and inadequacy of environmental education (Benn, 2004; Kagawa, 2007; Boyes et al., 2008), indicating the need to change the focus of environmental education in order to create more effective solutions to environmental issues of concern.

2.3. The challenge for environmental education

As a consequence of the aforementioned discussion of cognitive/behavioral issues, the biggest challenge for environmental education seems to be how to encourage sustainable lifestyles and discourage the unsustainable lifestyles of students by providing them with tools which are effective enough to make a broader societal impact (Fien, 2002; Sibbel, 2009). Littledyke (2006) stresses the need for strategically connecting the cognitive and affective domains of environmental education. This is also supported by Álvarez Suárez and Vega Marcote (2010) who tested an experimental didactic model on secondary school students, concluding that attitude-focused teaching methods can be more successful in evoking behavior changes in students than the use of purely knowledge-oriented tools.

In accordance with Leeming and Porter (1997, see above), Kagawa (2007) states that in a "rapidly changing and uncertain world faced by sustainability-oriented challenges, higher education needs to play an increasingly significant role in helping students become active, responsible citizens" (Kagawa, 2007, p. 335). For environmental education to be successful, strengthening responsibility is definitely key, both in high school and at university where innovative approaches are required to effectively prepare students to deal with environmental and sustainability issues.

In recent years, higher education for sustainable development (HESD) has emerged as being a field of enquiry which seeks to understand how sustainability may be advanced in the curriculums and operational activities of higher education institutions (Lozano, 2010; Waas et al., 2010). One of the main objectives of HESD is to play the traditional role of transforming societies and serving the greater public good (Fien, 2002; Wright, 2007, Waas et al., 2010; Stephens et al., 2008). According to Zilahy and Huisingh (2009, p. 1058) "universities are increasingly moving beyond the old science driven model and realize that their roles in society are broader than was the norm earlier". Higher education institutions also have a tendency to be conservative and resist change, which makes this transformation process rather difficult (Ferrer-Balas et al., 2010). Lozano (2006) states that universities typically focus on the topic of resource depletion, while incorporation of the much broader issue of sustainability requires radical innovation which is usually accompanied by resistance and conflict.

In order to foster behavioral change through education, Svanström et al. (2008) points out the importance of systemic and holistic thinking, the integration of different perspectives, the promotion of skills such as problem-solving, critical thinking, creative thinking, self-learning, communication and teamwork and becoming an effective change agent. "Transformative learning" is essential (see Wals et al., 2006) to make students able to integrate, connect, confront and reconcile multiple ways of thinking and handle uncertainty. Burandt and Barth (2010) adopt a similar view, stressing that, when dealing with sustainability issues, the development of these competencies is more important than the acquisition of knowledge. Competencies – unlike knowledge – can only be learned, not taught, so the learning setting for sustainability has to be designed in a way which provides students with the autonomy required to direct the learning process, as well as offering opportunities for collaboration. Self directed learning and the importance of practical experience are also emphasized by Dieleman and Huisingh (2006), Steiner and Posch (2006) and Svanström et al. (2008). According to Sibbel (2009) "the curriculum should include experiences which lead to a greater awareness of social and moral responsibilities. In particular, greater self-awareness of personal value systems and a willingness to revise them is required to prepare graduates for works towards sustainability" (p. 79). Providing students with all the skills necessary to become change agents is a fairly challenging task for environmental education programs and curricula; reality indicates only partial success so far. The main goal of environmental education should thus be to engage students with a complex toolset – containing cognitive, affective and conative elements – which fosters behavioral change.

3. Survey design and methodology

3.1. Research objective and assumptions

The objective of the research was to uncover how strong is the relationship between environmental education and the knowledge, attitudes and actual behaviors of high school and university students in Hungary. The ultimate goal of the research was to formulate recommendations for environmental education in Hungary in order to effectively foster more sustainable student behaviors at both high school and university level. The research is exploratory in nature, although based on some preliminary experience in this area (see Marjainé et al., 2010).

The main assumptions of the research were the following:

a) Levels of environmental knowledge would strongly correlate to the intensity of students' environmental education (see Asunta, 2004; Michalos et al., 2009; Marjainé et al., 2010).
b) Environmental knowledge, pro-environmental attitudes, consumer behavior and the everyday lifestyles of students are strongly interrelated factors which are not consistently correlated (see Bamberg, 2003; Kagawa, 2007; Boyes et al., 2008 and Michalos et al., 2009).
c) University students would be more aware of environmental issues than high school students, due to the extent and focus of environmental education, as well as their ages (see Asunta, 2004).
d) The role of technological development would be more optimistically evaluated in the younger cohort (the high school sample) while the need for consumption-related behavioral changes would be more clearly stressed by university students due to the different focus of environmental education at different levels (see Benn, 2004 and Boyes et al., 2008).
e) Regarding environmental awareness and consumer behavior, some typical clusters – hedonist, modest, uninterested and mixed groups – will be identifiable (see Marjainé et al., 2010).

3.2. Sampling, methodology and limitations

In order to test these assumptions, a survey was prepared for university (age 18–24) and high school (age 14–18) cohorts. University students from 23 of the country's 70 universities and colleges were surveyed on-line during October and November 2009. 2998

respondents were ultimately included in the sample (502 respondents were excluded due to incomplete responses). University students came from several fields of study (economics, medicine, law, engineering, the humanities). The representativeness of the sample could not be verified as the composition of the total population is unknown; however, sample size allows us to draw some general conclusions. The high school questionnaire was completed at three institutions – two from Budapest, and one from a village. It was completed individually by students during class time, supervised (but not moderated) by a teacher. The sample is not representative but its size (770 respondents) makes statistical analysis possible and reasonable.

In addition to lacking representativeness, further limitations of the research should be mentioned. The sample sizes do not correspond to the proportion of university and high school students in Hungary (the university sample is proportionately far larger). In the case of university students a self-selection bias can be anticipated as surveying took place online, while at the high schools every student from the selected classes was asked to respond. Moreover, university students have the option of specializing in environmental issues while this option does not exist at the high school level in Hungary (thus more non-committed students in the high school sample may be predicted than for the university sample). Finally, questions were not in every case formulated in exactly the same way which was necessary because of the differences in age and assumed knowledge of terminology of the two cohorts. The analysis described herein focused on comparable questions; any differences in the questionnaire structure are highlighted.

In addition to basic statistical analyses (frequencies and cross-tabs), multidimensional scaling (MDS) and cluster analysis were performed on the data. MDS is a powerful, complex methodological tool which can provide a comprehensive graphical view of the most important patterns in a sample and indicate the relationships between variables and respondents. Multidimensional scaling can be used for mapping the location of variables or cases based on similarities or differences between them. Through an iterative process, MDS adjusts the positions of variables/cases so that the distance between any pair of variables/cases is equal to the dissimilarity of their corresponding survey answers. Answers to questions (i.e. the values of variables) which often occur together in responses are located near each other; responses to questions which only very rarely occur together are spaced far apart. The process simultaneously adjusts all the positions so that the resulting figure represents a best fit for the data (for more on MDS and its limits see Steyvers, 2002; Buja et al., 2008). Results are graphically illustrated in a two-dimensional space (for further description of the utility of the MDS methodology see Holloway, 1990).

Survey results are presented following the logic of the literature review and research outline described above. An issue-specific interpretation of results is followed by a description of the outcome of the MDS analysis. Variables to be included in the MDS analysis are indicated *in italics* (in brackets) during the issue-specific interpretation for reasons of clarity.

4. Empirical results

4.1. Impact of environmental education on students

Hearing about environmental issues at school or in everyday life is likely to have an important effect on students' thinking and attitudes. In Hungarian high schools, there is no option to specialize in environmental issues but subjects like geography, biology, chemistry and physics include environmental topics. Hence, high school students are liable to be more exposed to environmental topics than university students. Only 11% of high school students reported to not taking one single environment-related course, while 29% of university students reported that they had not heard about the environment during their course of studies (*envedu0*). Of course, university students have most probably already heard about environmental issues during their high school education. The proportion of high school students who could name three or more subjects in which the environment was mentioned (*envedu+*) was about the same as that of university students who had taken specific environment-related courses (35%). 14% of the university sample were specializing in environmental issues at the time of sampling; this proportion was 0% for the high school sample (*envedu++*).

No difference was found between high school and university students regarding how well they reported being informed about environmental issues: the vast majority of respondents (74%) reported to being 'fairly well informed' (*inf_good*); about 9% 'very well informed' (*inf++*); about 16% 'fairly badly informed' and about 1% 'very badly informed' (the latter two are combined in *inf_low*).

However, students at different levels of education seem to have different drivers and information sources for their environmental knowledge (see Fig. 1). University students tended to be independently motivated to acquire knowledge, followed by education and the media as information sources. Friends and acquaintances were at the bottom of the list (parents, siblings and individual teachers were not included on the list in the university survey). High school students ranked the media first, and then own interest, with education following last (some way below). The importance of the Internet as a source of information was relatively high for high school students. Parents, siblings, friends, acquaintances and certain teachers also appeared as sources of information).

Results indicate that university students are far more purposeful and their interests as well as their information-seeking behaviors are shaped more by internal than external factors. This stems partly from the fact that university students voluntarily take part in their own environmental education, which is not the case for high school students.

Actual knowledge about the environment was appraised based on how many environmental problems students could list (*probl0* to *probl4+*). The average number of problems named by high school students was far fewer (2.0) than for the university sample (3.5). The difference is largely due to the fact that 18.8% of high school students were not able to name any problems, while this was true for only 2.3% of the university sample. The most important problems mentioned for both samples were water pollution, climate change, air pollution, biodiversity loss and the growing amounts of waste and man-made catastrophes.

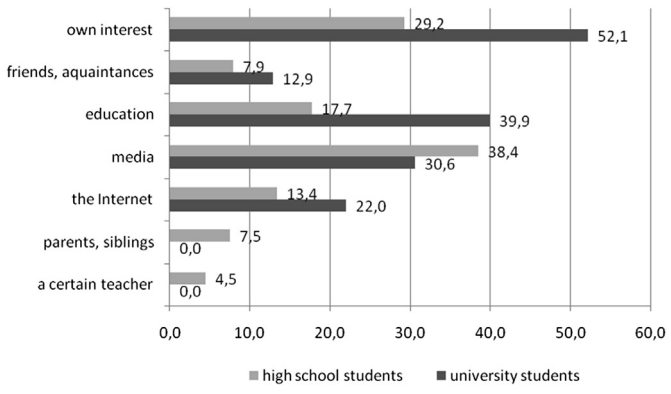

Fig. 1. Reasons for a change in environmental knowledge (% choosing the reason – up to two items could be chosen).

University students ranked water pollution and climate change as being the most important environmental problems, while high school students appeared to be more sensitive to air pollution and the destruction of wildlife, as well as catastrophes and urban problems. As opposed to university students, high school students did not perceive consumption patterns to be an important source of environmental problems. This lack of awareness is also reflected in opinions about the need for changes in consumer behavior for tackling environmental problems. University students attach far greater importance to the role of changing consumption habits than respondents from high schools (*lowC++* means 'totally agree with the need for behavioral changes in consumption', *lowC- -* means 'totally disagree'). Regarding the role of technological development, there was almost no difference in the opinions of high school and university students: around 11% 'totally agree' (*techopt++*), 42% 'tend to agree' (*techopt+*), 36% 'tend to disagree' (*techpess−*), and 11% 'totally disagree' (*techpess- -*) with the statement that technological development will be able to solve environmental problems. Results are illustrated in Fig. 2.

The above-described results clearly emphasize the importance of the content and focus of environmental education: university students are likely to hear much more about the nature and effects of consumer society than high school students. It can be also assumed that younger students are less critical of marketing messages which strongly encourage consumption.

Regarding the perceived effectiveness of environmental education, 30% of the university sample were absolutely convinced that environmental education is capable of changing the behavior of students (*edugood++*), 45% said 'more or less' (*edugood+*), 19% said 'not really' (*edugood-*), 3% said 'not at all' (*edugood- -*), and 3% did not know (*edudontknow*). Responses are significantly less optimistic in the high school sample, and 20% of students stated they 'didn't know' (see Fig. 3).

4.2. Consumer behavior

Consumer behavior is one of the areas where the awareness of students generally needs to be definitely increased (see Section 2.2). It was examined in terms of shopping habits, perceived barriers to increased consumption and standard of living. The rank order of shopping frequency for different types of goods is similar in the two samples: students buy books and newspapers most often, followed by clothes and accessories, cosmetics, then sports equipment, and finally, electronic devices (Fig. 4).

In the MDS analysis aggregate variables were constructed for the purchasing frequency of consumer goods (from *buy*0 meaning 'very rarely' to *buy4* meaning 'very often'; for further details see Table 1).

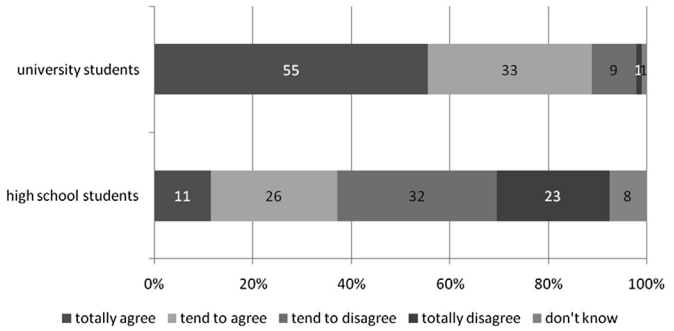

Fig. 2. Do you agree with the statement that to solve environmental problems, it would also be necessary to reduce consumption?

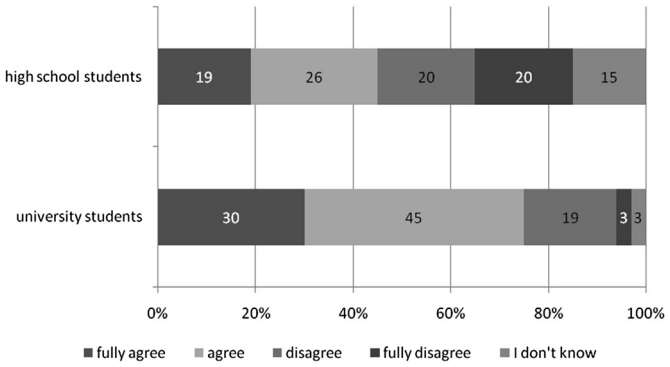

Fig. 3. Do you agree that environmental education is able to change the environmental behavior of students?

Shopping habits however, differ significantly: as opposed to our original expectations high school students report to being more enthusiastic consumers. They enjoy shopping more, are less able to resist discounts, strive more to keep up with fashion and technological trends, buy unnecessary things more often and are more likely to go shopping whenever they have money. In contrast, university students buy more according to their needs and are less ready to spend time and effort on shopping (Fig. 5).

High school students most typically try to keep up with fashion and technological trends and usually go shopping if they have money. Responses are somewhat inconsistent as the average value is almost the same for 'I buy things only if I really need them' (average: 3.8) as 'sometimes I buy things that I do not use later' (average: 3.5). University students showed more consistency in this regard (averages are 4.4 and 2.6, respectively). Consumption habits were aggregated for the MDS analysis based on their hedonistic character (*consum*0 indicates very modest and *consum3* very hedonistic consumption behavior).

The two samples also differed significantly according to the *perceived barriers to increased consumption*. Not surprisingly, all barriers were rated as being stronger by the university sample. This is understandable considering the fact that the university students reported to buying fewer consumer goods. Nonetheless, it appears that many would like to shop more if they had the time and money.

Ranking of the importance of barriers is almost the same for the two samples. A lack of money is the strongest barrier to consumption for both groups, while environmental considerations

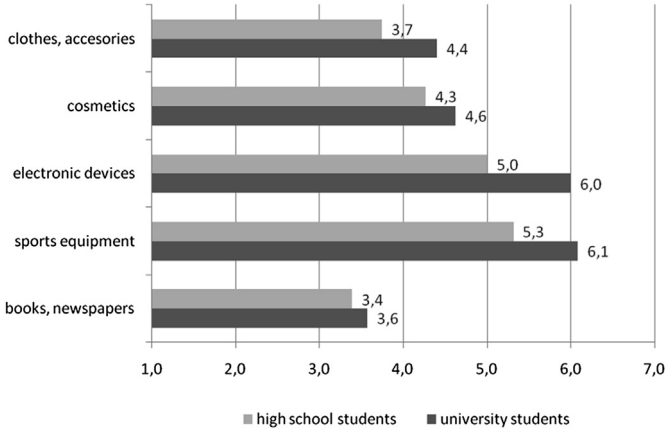

Fig. 4. Average frequency of buying consumer goods (on a scale of 1: more than once a week to 7: less than once a year).

Table 1
Variables included in the multidimensional scaling analysis and characteristics of clusters created by cluster analysis (data may be understood as being percentages).

N % of cases		Hedonist	Techno-optimist	Careless	Familiar	Active	Total *N*	%
		533 14.30	802 21.52	493 13.23	1079 28.96	819 21.98	3726	100.00
Variables	**Content of the variable**							
act0	Low activity in env. lifestyle	.95	.05	.72	.09	.05	1045	28.05
act+	Fair activity in env. lifestyle	.04	.85	.18	.52	.12	1443	38.73
act++	High activity in env. lifestyle	.01	.11	.10	.39	.83	1238	33.23
Lifestyle	Fig. 9						3726	100.00
Barrdontknow	I don't know	.14	.02	.08	.02	.01	163	4.37
Barrease	Convenience prevents me	.44	.38	.48	.39	.24	1401	37.60
Barrgoodenough	I already live env. consciously	.12	.13	.13	.18	.38	735	19.73
Barrirrelvnt	I don't see the point in it	.20	.04	.13	.02	.01	228	6.12
Barrlackofknow	Not enough available information	.55	.50	.33	.28	.29	1389	37.28
Barriers of being env. conscious	(More than one answer was allowed to select) Fig. 10						3916	105.10
Tram	I would prefer public transport	.08	.26	.27	.33	.21	905	24.32
Car	I would prefer to go by car	.83	.49	.57	.15	.07	1332	35.80
Bike	I would prefer to go by bike	.09	.25	.16	.52	.72	1484	39.88
Preference in appropriate circumstances	Figs. 6–8						3721	100.00
Buy0	Buying consumer goods very rarely	.05	.14	.25	.31	.20	760	20.45
Buy1	Buying consumer goods rarely	.08	.17	.21	.25	.21	725	19.50
Buy2	Buying consumer goods on average	.12	.28	.21	.18	.22	768	20.66
Buy3	Buying consumer goods often	.24	.21	.23	.16	.21	759	20.42
Buy4	Buying consumer goods very often	.51	.20	.10	.10	.15	705	18.97
Buying goods	Fig. 3						3717	100.00
Consum0	Very modest consumer behavior	.06	.15	.23	.38	.22	855	22.97
Consum1	Fairly modest consumer behavior	.12	.34	.34	.27	.35	1076	28.91
Consum2	Fairly hedonistic consumer behavior	.21	.25	.30	.20	.22	861	23.13
Consum3	Very hedonistic consumer behavior	.61	.26	.12	.15	.22	930	24.99
Consumer behavior	Fig. 4						3722	100.00
Edudontknow	I don't know	.17	.04	.08	.02	.02	193	5.18
Edugood++	I totally agree that environmental education helps solve the problems	.15	.29	.12	.08	.70	1041	27.95
Edugood+	I agree that …	.28	.46	.16	.75	.15	1535	41.22
Edugood−	I disagree that …	.18	.17	.50	.13	.11	710	19.07
Edugood−−	I totally disagree that …	.21	.03	.14	.02	.02	245	6.58
							3724	100.00
Envedu0	I studied no or few env. subjects	.52	.58	.90	.45	.44	2038	54.70
Envedu+	I studied more env. subjects	.48	.35	.07	.36	.38	1275	34.22
Envedu++	I am specialized in env. issues	.00	.07	.02	.18	.18	413	11.08
							3726	100.00
Inf++	Very well informed	.05	.05	.08	.10	.17	353	9.48
Inf_good	Fairly well informed	.71	.76	.66	.79	.74	2769	74.34
Inf_low	Fairly and very badly informed	.24	.20	.26	.11	.09	603	16.19
							3725	100.00
LowC−−	I strongly disagree that reducing consumption is necessary to solve environmental problems	.26	.02	.08	.01	.01	208	5.58
LowC−	I disagree that…	.35	.19	.17	.04	.06	516	13.85
LowCdontknow	I don't know	.08	.02	.03	.01	.01	91	2.44
LowC+	I agree that…	.18	.42	.56	.24	.27	1185	31.80
LowC++	I strongly agree that…	.13	.35	.16	.71	.65	1726	46.32
							3726	100.00
Paydontknow	I don't know	.01	.04	.05	.04	.02	115	3.09
Paymore++	I strongly agree that I am ready to pay a bit more for env. products	.05	.05	.07	.14	.18	405	10.88
Paymore+	I agree that…	.56	.66	.28	.44	.70	2017	54.16
Paymore−	I disagree that…	.30	.20	.46	.35	.09	995	26.72
Paymore−−	I strongly disagree that…	.08	.04	.15	.03	.01	192	5.16
							3724	100.00
Prbl 0	No env. problem mentioned	.18	.04	.11	.01	.02	212	5.69
Prbl 1	1 env. problem mentioned	.13	.12	.17	.07	.10	410	11.00
Prbl 2	2 env. problems mentioned	.21	.24	.21	.14	.19	713	19.14
Prbl 3	3 env. problems mentioned	.22	.30	.26	.23	.20	896	24.05
Prbl 4pls	4 or more env. problems mentioned	.26	.29	.25	.56	.50	1495	40.12
							3726	100.00
Techdontknow	I don't know	.12	.03	.05	.02	.03	159	4.27
Technopt++	I strongly agree that technological dev. is able to solve env. problems	.11	.08	.17	.09	.12	398	10.68
Technopt	I agree that…	.36	.72	.32	.25	.39	1510	40.53
Technpess	I disagree that…	.30	.13	.38	.52	.33	1284	34.46
Technpess++	I strongly disagree that…	.10	.04	.09	.12	.14	375	10.06
							3726	100.00

(*continued on next page*)

Table 1 (*continued*)

N % of cases		Hedonist	Techno-optimist	Careless	Familiar	Active	Total *N*	%
Yr14_17	Age between 14 and 17	.64	.08	.19	.01	.02	529	14.22
Yr18	Age of 18	.15	.08	.16	.05	.03	303	8.15
Yr19	Age of 19	.08	.12	.16	.13	.08	419	11.27
Yr20_21	Age between 20 and 21	.06	.27	.18	.25	.21	779	20.95
Yr22_23	Age between 22 and 23	.04	.18	.12	.23	.19	620	16.67
Yr24_28	Age between 24 and 28	.03	.14	.12	.18	.21	550	14.79
Yr29pls	Age of 29 or more	.02	.13	.07	.16	.25	519	13.96
							3719	100.00

are much less important and a dislike for shopping is uncommon (Fig. 6).

Respondents from the two samples seem to differ in their *standards of living*: while three quarters of the high school students considered their standard of living to be above the average of their peers, this proportion was 59.5% for university students. These results can be compared with the actual sums reportedly spent by the respondents on various products. High school students spend significantly more money on consumer goods (HUF 11273 on average) than university students (HUF 7740 on average) and this finding also holds true for leisure activities (HUF 11500 vs. 8912). High school students in the sample obviously had much more money to spend than university students as the former tend to completely rely on their parents for financing while the latter have (at least partly) to earn their spending money themselves as well as finance their housing arrangements.

4.3. Pro-environmental behavior

The 'pro-environmental behavior' of students was characterized through analysis of transport habits and everyday lifestyle choices. *Transport habits* are partly determined by the distance of the school from home as well as by the modes of transport available. High school students surveyed live, on average, further from their schools than university students. This characteristic is independent of environmental attitude but has a great influence on choice of transport. A far bigger proportion of university students (32%) walk to their place of study than high school students (10%), while the latter use public transport much more often (74% vs. 45%). It is understandably more common for university students to use their own cars, while 'park and ride' transportation is more commonly used by high school students (and their parents), probably also due to the greater distances. Traveling by bike was more common for the university sample. In both groups about 13–15% of the students use a car everyday in some way.

Attitudes about transport were examined by asking respondents whether they would use a certain mode of transport (bike, tram and car were the variables used for the MDS analysis) more frequently under improved circumstances (such as better storage facilities for bikes, more frequent public transport, cheaper gasoline for cars). Given more favorable circumstances, bikes would be significantly more preferred by university than by high school students, while cars would be the preferred mode of transport of high school students in much higher proportions. Responses about the use of public transport are greatly distorted by those who already travel using this method of transportation, but correcting for these answers it is possible to say that 69% of the remaining high school and 60% of the remaining university students would switch to public transport if conditions improved.

Interestingly, the desire of high school students to switch to using a car was independent from the distance they had to travel, and this was also true of public transport. Only in the case of bicycles did we find the expected inversely proportionate relationship to distance. In both samples, the desired mode of transport was related to the current mode: those who walked or traveled by public transport at the time of surveying reported that they were more willing to switch to bikes than car-users. Public transport would be most preferred by those who currently use it in combination with driving, probably because they were obliged to use P + R solutions due to the inadequacy of public transport. In the high school sample, those who used bikes would not choose to travel by car even if they could.

Regarding *everyday behavior*, the vast majority (93.5%) of university students consider themselves to be more environmentally conscious than their peers, while this proportion is 'only' 65% for high school students. Their self-reported consumption habits certainly justify this claim in favor of the university group but it should be noted that a self-reporting bias is present for this sample group. How the survey question about everyday activities was formulated may also influence responses in a positive direction for

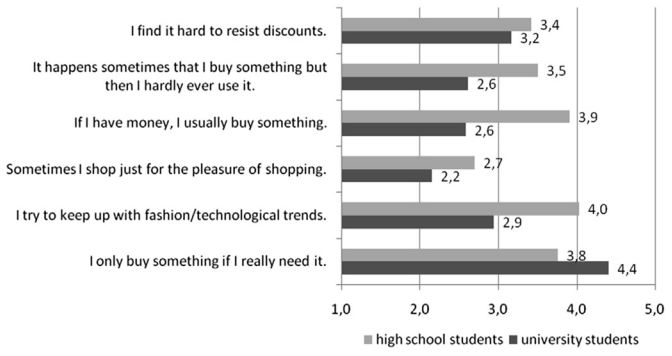

Fig. 5. Characteristics of shopping behavior (on a scale of 1: not at all typical of me to 6: very typical of me).

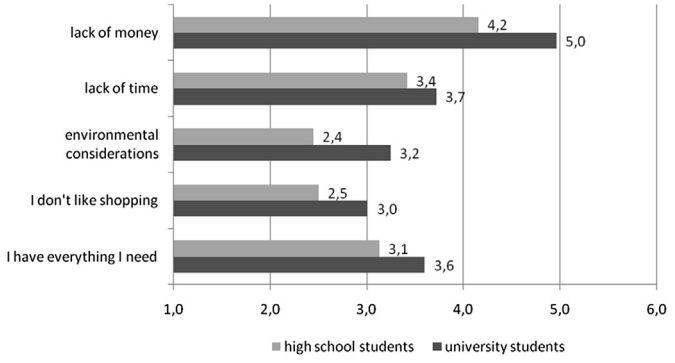

Fig. 6. How much do the following factors hold you back from shopping more? (on a scale of 1: does not hold me back at all to 6: holds me back strongly).

the university sample (due to the fact that someone might perform a certain activity only on an occasional basis but this would be counted as a positive response), but the differences are much larger than expected for almost every pro-environmental activity (see Fig. 7).

University students reportedly engaged (at least occasionally) in almost all the listed forms of pro-environmental behavior. The three most common environmental activities are compressing plastic bottles before discarding them (regularly done by 81%); collecting hazardous waste separately (68%) and choosing environmentally friendly modes of transport (67%). Interestingly, 21% of them never collect their waste selectively. Three other activities are done infrequently: 39% never consider the manufacturers' reputation when buying something, 34% never buy products with an environmental label and 26% never try to use fewer chemicals when cleaning the house. This experience clearly reflects the focus of promoted activities in social communication (similar results were found using a representative survey of 1000 Hungarian adult respondents, see Zsóka, 2011).

High school students undertake their pro-environmental activities mainly in accordance with the behavior of their families. Just as with the university sample, the majority travel in an environmentally friendly way, compress bottles before discarding and collect hazardous waste separately. However, pro-environmental shopping-related activity is rare: 74% never buy products with an environmental label, 71% do not pay attention to buying local products and 62% do not make efforts to reduce the use of disposable products. These findings support our previous observation that high school students fail to make a connection between shopping habits and the state of the environment. However, around half of them nevertheless do engage in several types of pro-environmental behaviors, offering an entry point for further environmental education.

Here, aggregation was employed in the MDS analysis (from act0 meaning a low level of activity, to act++ meaning a high level of pro-environmental activity).

An environmentally-conscious lifestyle is often restricted by perceived *barriers* (see Fig. 8).

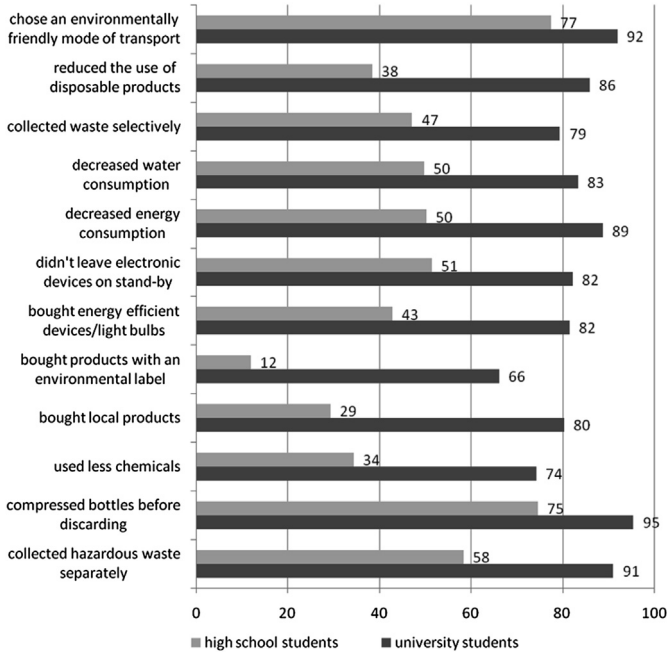

Fig. 7. Pro-environmental behavior in the two samples (% of respondents performing the activity).

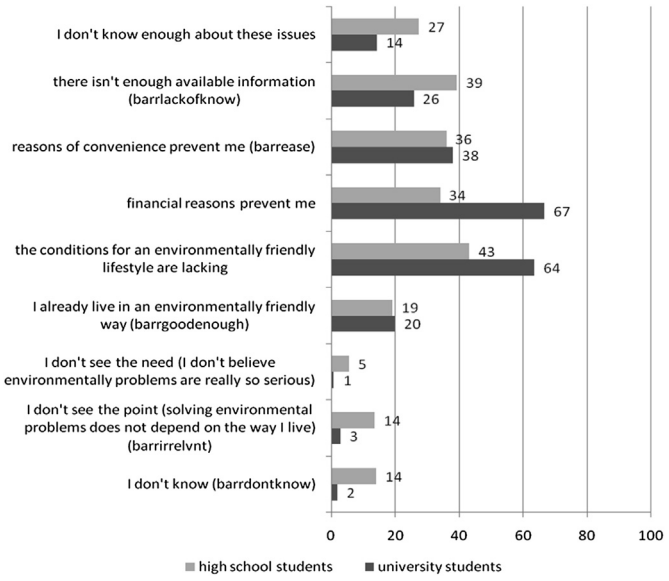

Fig. 8. What are the main factors preventing you from living in a more environmentally conscious way? (%, up to three answers could be chosen).

University students are very clear about two barriers: a lack of money and a lack of the necessary structural conditions for living in an environmentally friendly way. These items were cited by many university respondents (in significantly higher proportions than for the high school sample). For the high school sample, a lack of information and the shortcomings of their own knowledge about environmental issues also appear to be problems. Interestingly, the share of respondents who reported that 'reasons of convenience' were a barrier was similarly high in both groups – an issue that can and should be improved through environmental education. About a fifth of respondents from both samples report that they already live in an environmentally friendly way. The share of those who doubt the severity of environmental problems or believe that one person's actions do not make a difference are very low in the university sample but slightly higher in the high school group. These results clearly show that an increase in knowledge and the creation of better framework conditions could have a positive effect on the behavior of students.

We also asked respondents about their *willingness to pay* slightly more for environmentally friendly products. In the MDS analysis the variables range from *paymore*−− (meaning strong disagreement) to *paymore*++ (indicating strong agreement).

5. Illustration of relationships using multidimensional scaling (MDS)

5.1. Mapping the relationship between variables using MDS analysis

The analysis of the relationships between 14 variables from our questionnaire highlights the nature of Hungarian students' environmental knowledge, values and actual behavior in an explicit way. To visualize the data easily and to standardize different scales of measurement all variables were transformed into binary variables (thus gaining 58 binary variables as an input for our analysis). Table 1 presents the details, with an explanation of the content of variables in addition to the references made in the previous chapters. Using multidimensional scaling (MDS) the structure of distance-like data is displayed as a geometrical picture. The structure of the 58 variables is illustrated in two dimensions that

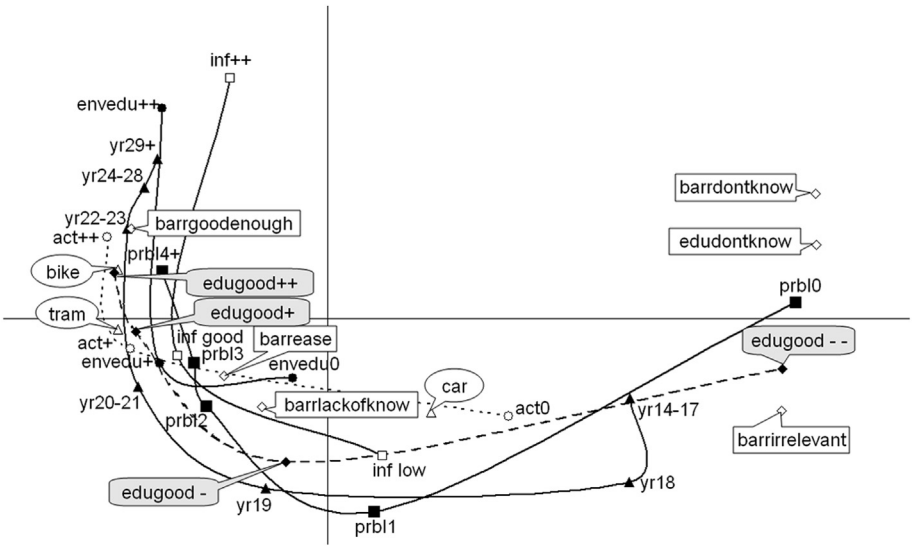

Fig. 9. Distance of the variables in a two-dimensional space: knowledge and value oriented edition of the multidimensional scaling output (see legend in Table 1).

approximate the distances between pairs of objects. Each variable is represented by a point in a two-dimensional space. The points are arranged in this space so that the distances between pairs of points have the strongest possible relation to the similarities between the pairs of variables (that is; two similar variables are represented by two points that are close together, and two dissimilar variables are represented by two points that are far apart (see Chapter 7 in Young, 1985)). Calculations were carried out using SPSS (PASW Statistics 18). The ALSCAL (alternating least squares approach to scaling) algorithm was used which optimizes the fit of squared Euclidean distances to the dissimilarities. Data distances were created using the Lance-Williams binary distance method. Young's S-Stress formula is .37127 which is acceptable as 58 variables were used (constructed from 14 different questionnaire items).[2]

Fig. 9 and Fig. 10 illustrate the distances between the analyzed variables. Two graphs were prepared for the sake of transparency but they are both the output of the same MDS procedure, reflecting the same space and dimensions for all variables (see the 'edugood' variables included in both graphs for illustration).

Based on the content of the variables (see Table 1), clear statements can be made about the relationships between variables and the consistency of environmental awareness in the total sample. Obviously, a high level of environmental knowledge (reflected in information (inf++) and the high number of environmental problems mentioned (prbl 4+) are close to a high level of environmental education (envedu++), in line with a positive opinion about the effects of environmental education on behavior shaping (edugood++). A pro-environmental lifestyle is reflected in a high level of action (act++) which is very much in accordance with the willingness to use environmentally friendly modes of transport (e.g. bike or tram) under better conditions and with the perception of there being no barriers to living a more environmentally conscious life because the respondent is already conscious enough (barrgoodenough). The opposite is true for the negative responses. Environmentally 'careless' behavior is also displayed consistently as the 'don't know' types of answers (i.e. variables) are close to each other. Variables which (visually) appear close (i.e. are similar) to each other may be considered as being parts of distinct clusters.

Obviously, age appears to be related to environmental consciousness. Beyond years of education, age itself can play a role in this phenomenon, as people usually become more conscious and responsible while growing up. Here, further research would be necessary to distinguish the impact of education from that of age.

Fig. 10 adds further detail to the overall picture. A high level of information (inf++, see Fig. 9) occurs together with the willingness to paymore for environmentally friendly products (paymore++) and with a pessimistic attitude towards technological development as a solution to environmental problems (techpess++). The characteristics of consumer behavior are also close to each other, meaning that modest, less hedonistic consumer behavior (consum0) and a low frequency of buying consumer goods and services (buy0 and buy1) are in the same region, together with strong agreement about the necessity of reducing consumption for the purpose of promoting sustainability (lowC++) and with a strong belief in the effectiveness of environmental education in positively changing behavior (edugood++). Again, the same is true for those variables which represent 'negative' attitudes or behaviors (consum3, buy4, techopt++, lowC−, edugood−−), which are close to each other in the display.

5.2. Clustering respondents using MDS analysis

To organize information about sample respondents, cluster analysis (K-means cluster analysis using SPSS) was used at first. The aim was to reveal groups which are highly homogenous internally (i.e. members are similar to one another) but highly heterogeneous externally. In order to do this: (1) five initial cluster centers were computed using a random sample of 400 cases; (2) these cluster centers were used as initial clusters, then a second random sample of 800 cases was developed and these cluster centers were updated iteratively; (3) the whole sample ($N = 3726$) was classified around the five cluster centers gained by the previous steps. For detailed information about our final clusters see Table 1. In each case the cluster name represents the most characteristic feature of the variables behind the clustering.

To visualize the relationships between the clusters multidimensional scaling was again used. Several random samples of 100 respondents were first developed (the maximum capacity of the

[2] According to Sturrock and Rocha (2000) the S-Stress threshold for a two-dimensional 58-variable MDS analysis is .375. According to this, there is a less than 1% chance that the variables analyzed are without any structure.

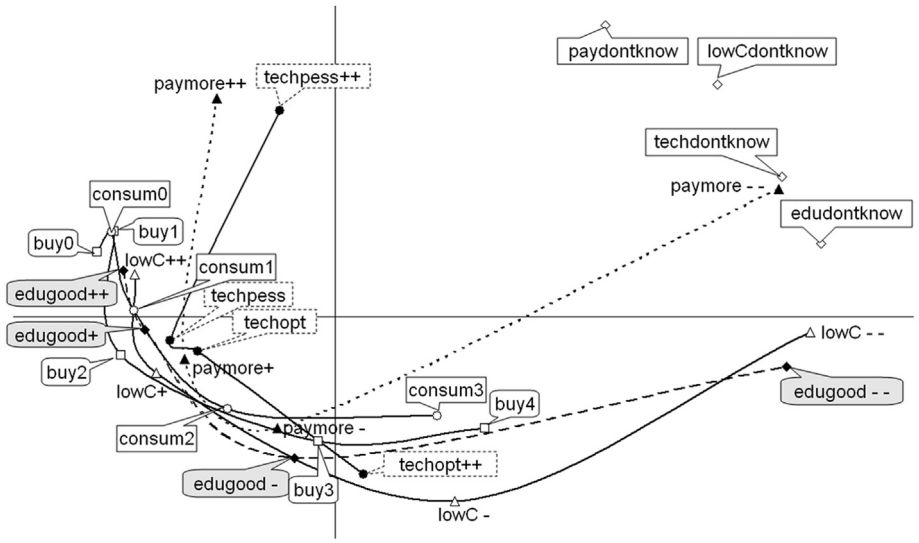

Fig. 10. Distance of the variables in a two-dimensional space: consumer behavior oriented edition of the multidimensional scaling output (see legend in Table 1).

MDS-algorithm in SPSS is limited to 100 cases). Second, the identified cluster memberships of these random cases were identified in a two-dimensional space for every sample. As a proxy and summary of cluster positions Fig. 11 was produced as a map of clusters. This indicates that MDS is somewhat superior to pure cluster analysis as it shows overall distances between clusters more graphically. Neighboring or overlapping clusters (e.g. "Familiar" and "Active") have more in common than distant clusters (e.g. "Active" and "Hedonist"). What is more, this two-dimensional space of *cases* is highly similar to the two-dimensional space of *variables* shown above: typical variables for a specific cluster and the cluster itself are usually in roughly the same place on their own map (see for example the position of the cluster of "Hedonists" on the map in Fig. 11 at bottom right and the position of the variable "strongly disagree with lowering consumption"/lowC−−/on the map in Fig. 10).

The 819 members of the **Active cluster** appear to be rather consistent in their environmental consciousness. They are very active in everyday pro-environmental activities, know much about environmental problems, consume modestly and are aware of the benefits of sustainable consumption. They are mainly university students with a very positive attitude about the effectiveness of environmental education. 18% specialize in environmental issues.

The **Familiar cluster** includes 1079 respondents who are obviously familiar with environmental issues and display rather similar features to the Active group except that they are younger, demonstrate less everyday pro-environmental behavior and are less committed to opting for environmentally sound modes of transport.

The **Techno-optimist cluster** (Technopt) contains 802 members, 80% of whom believe in the potential of technological progress to solve environmental problems. Members can be found both among the younger university cohort and in the high school student sample. The level of their environmental engagement is considerably lower than that of the Active and the Familiar clusters. Almost half of them would opt to travel by car more often.

The **Hedonist cluster** with 533 members can be characterized by its highly hedonistic consumer behavior, high purchasing

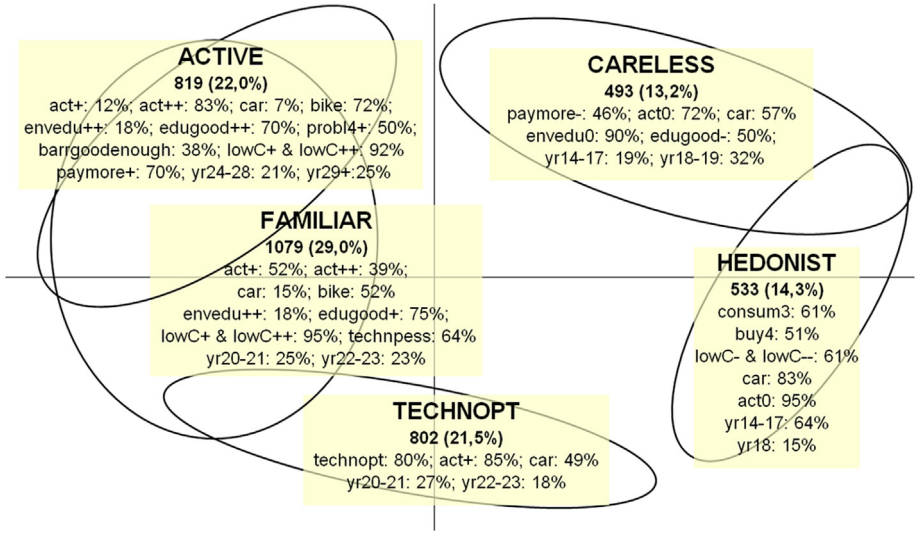

Fig. 11. Positioning of clusters of respondents in the two-dimensional space of the multidimensional scaling analysis (see legend in Table 1).

frequency, convenience-orientation (83% of respondents would prefer to use the car more often), negative attitude towards reducing consumption and a very low frequency of everyday environmental activities. Most members of this cluster (79%) are high school students.

Finally, the 493 members of the **Careless cluster** are those who have not participated in environmental education yet, do not believe in the positive effects of environmental education, do not practice pro-environmental activities and often responded to questions by selecting the "I don't know" option. Their ages are variable.

The clusters clearly represent differences in behavior and environmental awareness. It is obvious that levels of environmental knowledge, attitudes towards a pro-environmental lifestyle, consumption, environmental education and actual everyday behaviors are significantly related and result in more or less consistent patterns of behavior.

6. Discussion

Our research was designed to provide a comprehensive overview of the relationship between environmental education and elements of the pro-environmental behavior (knowledge, attitudes and reported actual behavior) of students. The comparative analysis of students at different levels of education and specialization is unique in the literature, as surveys usually focus on either level. In spite of its complicated nature, we deliberately chose to undertake a comparative analysis to highlight the differences in the pro-environmental behavior of students which result from their education.

Regarding coherent pro-environmental behavior, our survey results definitely support the arguments of Kollmuss and Agyeman (2002), Bamberg and Möser (2007), and Arbuthnott (2009) by indicating that environmental knowledge and attitudes are not fully reflected in everyday activities. However, the level of environmental knowledge, commitment, and environmentally conscious action *are* found to be strongly interrelated and they significantly correlate with the intensity of environmental education (as graphically shown in the output of the MDS analysis). Further research would clearly be necessary to establish causal links between the investigated variables.

The university sample demonstrated a significantly higher level of environmental knowledge than the high school cohort. This is partly due to their higher level of education and their age, but also because of the fact that the university students were surveyed online on a fully voluntary basis, while high school students completed the questionnaire in the classroom, not really having the option to not respond. Self-reporting bias can be observed in both samples.

Opinions about the perceived environmental benefits of technological development were similar for the two samples (and were basically in line with results of Benn, 2004). Techno-optimism was found to be in an inverse relationship to environmental awareness. Regarding consumption, university students perceived the importance of changing consumption patterns more clearly, which may derive from the different focus of environmental education at the high school and university levels, as well as from age. The consumption patterns of students were in line with those beliefs, and we came to the unexpected conclusion that university students (at least in the sample analyzed) were significantly less hedonistic in their consumption activities than their high school counterparts. In addition, students in the university sample were far more purposeful and their interests and information-seeking behaviors were shaped more by internal than external factors, in contrast with high school students (for comparison, see Asunta, 2004).

As 'sustainable consumption' and 'sustainable lifestyles' are continually given increasing importance in the literature and policy making, the contribution of environmental education to the awareness-raising process and to promoting desirable behavioral changes is of crucial importance. According to the results of our research, participation in environmental education and the belief that environmental education is able to foster behavioral change are closely related. This is either because committed students specialize in environmental issues and expect environmental education to achieve its goal of awareness-raising, or (and) because they perceive the positive impacts of environmental education on their own lives. The exact causal relationship is difficult to identify.

As seen in the literature review, several researchers (see Bamberg, 2003; Littledyke, 2006; Kagawa, 2007; Michalos et al., 2009; Álvarez Suárez and Vega Marcote, 2010) have stressed the importance of attitude shaping in environmental education which means going beyond the goal of simply providing knowledge to students. Our results support the findings of the quoted studies in the sense that participation in environmental education and specialization in this area were very strongly correlated to pro-environmental attitudes and higher affective awareness, in addition to a higher level of knowledge.

However, the limitations of the research must be noted when formulating conclusions and implications. The main limitation of the survey is that representativeness was not ensured, which prevents us from generalizing conclusions for the total population of students in Hungary. The university sample, with its high number of respondents, provides a more reliable basis for general statements, but the high school sample would definitely benefit from supplementary research (e.g. increasing the sample size), even if different types of schools were involved in the survey.

7. Conclusions

The causalities between environmental education and pro-environmental behaviors are difficult to measure in a reliable way. The range of aspects which influences the behavior of high school and university students is very wide and the interrelationship of those aspects is rather complex. It is difficult therefore to separate the effects of environmental education from the many other factors (e.g. the role of age in personal responsibility, the impacts of various information sources, habits and norms). Recent surveys carried out on university and/or high school students have mainly focused on knowledge, attitudes and behavior patterns and have analyzed relationships rather than causalities. The impact of environmental education has not been directly measured in those pieces of research and a clear delineation can be identified between research which focuses on interrelated behavior patterns and policy papers which address the challenges of and strategies for environmental education. Consequently, a lesson derived from both a literature review and our survey is that there is a need to define and utilize research methods which are better able to assess the effectiveness of environmental education in shaping the behavior of students.

When comparing the two samples, environmental awareness proved to be considerably higher in the university sample, not only according to respondents' self-assessment, but also with consumer behavior and the practice of pro-environmental activities. In both sample groups, 'light green' activities were most preferred, but university students proved to be much more aware of the interconnection between consumption and environmental issues. Results of the two multivariate analysis procedures support our main findings, while illustrating the distance of variables from each other (multidimensional scaling) and the distance of respondents based on those variables (cluster analysis) in a transparent and

informative way. It appears that the characteristics of consistently conscious individual behavior are significantly interrelated in the sample at both extremes, while the identified clusters represent different levels of environmental awareness. The typology generated offers useful information for environmental educators.

The main implication of this research for environmental education is that educators should be aware of the high variety of commitment and interest among students towards environmental and sustainability issues when designing courses and curricula for them. Current environmental education seems to make the mistake to primarily reach committed students and further increase their pre-existing environmental consciousness, while missing the focus on students who are less committed. Hence, environmental education has to be made capable of addressing the different knowledge, attitudes, and behaviors of students in a differentiated, targeted and effective way in the future. The content of environmental education should be better harmonized at different educational levels with a stronger focus on sustainable living and more sustainable consumer behavior. Such an approach could provide the continuity of a coherent framework for the most important environmental issues for students (while possibly reducing the effects of age). In addition, the opportunities which exist to provide credible, positive, practical examples of sustainable behavior are far from being adequately utilized in environmental education – at least in present day Hungary. Focusing on reducing environmental load through encouraging a variety of behaviors is a promising approach, in parallel with the constant provision of positive feedback about behavioral changes. The greatest challenge for environmental education is to create, educate and activate internally motivated, conscious and committed students who behave in a consistently pro-environmental manner. Such students are key drivers of a more sustainable future.

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