

Attitudes to environmental education in Poland

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This study analyses attitudes to the natural environment of Polish secondary school pupils from four selected regions of Poland. These were defined as knowledge regarding the environment and actions for the benefit of the natural environment as these result from the fundamentals of the environmental education curriculum track. Other results of the study are discussed and some recommendations made regarding those features that need to be included in formal environmental education in order to maximise pupils' learning outcomes.

Key words: Environmental education; Curriculum; Environmental attitudes; Region-related factors; Secondary educational levels.

Introduction

Environmental education in Poland

By 1999, formal environmental education was conducted chiefly in biology lessons, and extra-curriculum and club activities. As in many other countries, this was the responsibility of biology teachers (Mongensen, 2003). Initially, environmental education was, in practice, limited to providing pupils with knowledge about environmental protection.

A reform of the education system introduced changes to the structure of the education system and to the Core Curriculum. Integrated, multifaceted education focused on practical knowledge was to be the tool in implementing the reform (Buchcic, 2002; Cichy, 2003). From the viewpoint of environmental education, the most essential change was the introduction of the subject of 'nature' in primary schools and a new method of teaching about the environment and ecology – the environmental interdisciplinary track – at all stages of education (beginning in 4th grade of primary school).

The educational track scheme makes it obligatory to include topics pertaining to environmental protection in all school subjects. It is also permitted to teach the content of the educational track during separate modular educational classes lasting a few hours. According to the Core Curriculum, the main goal of environmental education is to develop in children and young people an attitude of responsibility for the environment (DzU 1999; No 14). That is why it is vital that teachers address environmental problems at local and regional scales (Buchcic, 2002; Cichy 2003; Stoczkowska, 2002a).

The study conducted in the Mazovian Province indicates that the requisite environmental content is often taught with similar topics during lessons of particular subjects, sometimes in an unsynchronised manner and without using a separate teaching programme. The ambiguity of the clauses contained in the relevant act of parliament, and the general formulation of recommendations, lead to a variety of ways of teaching the educational track and a freedom in choosing educational programmes: this can result in discrepancies in pupils' knowledge

and skills across various schools and parts of Poland (Stoczkowska, 2002b).

The study of environmental attitudes

So far, only a few researchers in Poland who consider formal education an important element in shaping environmental attitudes in young people (Palmer et al, 1998), have studied these attitudes in post-primary school pupils, i.e. gymnasium (aged 13-16) and lyceum pupils (aged 17-19). Even then, the researchers' approaches were often inconsistent in terms of methodology and content. These studies, conducted on nationwide samples and usually dealing with various definitions of environmental awareness (including the pro-environmental attitude of society) did not take into account younger respondents (Burger, 2005; CBOS, 2000).

Studies on pupils of all grades, conducted in the 1990s, were chiefly undertaken by teaching staff. These studies pertained only to the environmental knowledge required by the teaching programmes on environmental protection and awareness of threats to the environment. The results revealed that this knowledge was incomplete and composed of unrelated facts and data (Domka, 2001).

After 2000, when the educational reform was implemented, researchers began to emphasise the importance of an active approach towards the environment and the importance of school pupils' opinions on the protection of nature. Researchers concluded, though, that action on environmental issues was rarely undertaken (Grodzińska-Jurczak and Friedlein, 2002; Obrębska, 2004; Potyrała et al, 2004). Unfortunately, most of the studies were conducted locally and covered not more than two provinces. This limited the possibility of studying the relationship between the region and environmental knowledge, the pupils' opinions and their actions for the benefit of the environment.

The goal of this study

To study the effectiveness of environmental education in

schools, especially that provided as part of the environmental education track, it was decided to study pupils' attitudes to the natural environment. By making reference to the classical theory of attitudes, two components of this attitude were examined: environmental knowledge, and behaviour and actions for the benefit of the environment. The authors also assumed that the creation of most pro-environmental behaviours is accompanied by an emotional factor: the study of the latter was however abandoned in favour of a more thorough exploration of other components of the environmental attitude (Aaronson, 1995).

From the environmental content required by the Core Curriculum, the authors selected issues pertaining to Poland's current environmental problems, including biodiversity protection, municipal waste management, water pollution and energy consumption. In the case of action, the focus was on activities that relate to the understanding and practical application of knowledge: declarations of pro-environmental choices and behaviour in daily life (e.g. waste separation, water protection and conservation, as well as energy saving).

It was decided to study the effect of the region in which the respondents lived. For this purpose, four provinces were selected, differing in their degree of environmental degradation and pollution, as well as the availability of valuable natural areas. The authors assumed that the occurrence of valuable natural areas or degraded areas would have an effect on the residents' behaviour and their environmental knowledge (Burger, 2005). It was also decided to analyse the contribution of social and economic factors, i.e. the size of the respondent's place of residence, their gender, their parents' education and employment status.



Figure 1. Poland, showing the provinces included in the study.

The area of the study

Four provinces have been selected for the study: the Warmian-Mazurian, Malopolska, Mazovian and Silesian Provinces (Figure 1). The provinces differ in their environmental pollution indices, preservation of natural assets, and type of economic development and industrialisation (GUS, 2002; Podgajniak, 2002) (see Table 1).

The Warmian-Mazurian Province is a region with almost no industry and its environment is almost unpolluted and has remained unchanged. The only problem is municipal waste, little being segregated or recycled. Equally attractive in terms of natural assets is the Malopolska Province. Its overall pro-

Table 1. Comparison of demographic and environmental characteristics of the provinces under study (data for 2001-02) (GUS, 2002).

	Province			
	Warmia-Mazury	Malopolska	Mazovia	Silesia
Area [thousands of hectares]	2420	1514	3558	1229
Population density [persons/ km ²]	61	214	144	393
Urbanisation [percentage of the population living in urban areas]	60	50	65	79
Unemployment rate	29	16	14	24
Percentage of devastated or degraded land	0.2	0.2	0.15	0.48
Percentage of arable land	54	59	67	51
Percentage of built up or urban areas	3.5	5.1	4.5	9.2
Percentage of areas protected by law	54	58	30	22
Dust emissions by plants particularly harmful to the environment [tonnes/year]	2.2	14.4	13.7	32.8
Gaseous emissions (excluding CO ₂) by plants particularly harmful to the environment [tonnes/year]	13.4	189.9	201.8	571.2
Sulphur dioxide emissions by plants particularly harmful to the environment [tonnes/year]	6.3	58.4	136.9	145.6
Percentage of substandard surface waters	49	57	80	70
Waste rendered harmless to be landfilled (excluding municipal waste) [thousands of tonnes/year]	17.4	1162.2	1593.4	4048.4
Landfilled municipal waste [kg/person]	320	199	284	319
Percentage of municipalities collecting hazardous waste	5.2	7.8	9.5	25.9
Percentage of municipalities segregating waste	9.5	41.1	22.2	34.9

Legend (the scale values are given for comparison only and do not represent absolute values) low medium high

tected area is large and the province is also rich in historic buildings and sites. There are several kinds of industry in the Malopolska province. It has only moderately high air pollution and well developed waste management.

The most economically developed is the Mazovian Province. Like Silesia, this is one of the most polluted provinces in Poland. The region is fairly developed, with natural assets preserved only in a few sites. Only one-fifth of the Mazovian Province municipalities segregate municipal waste. Silesia – the most environmentally troublesome province – is a highly populated and economically well-developed region with a low proportion of areas with natural assets, while it has heavy air and water pollution. A large part of the province consists of devastated, degraded land with industrial waste landfills. In many Silesian municipalities the segregation of recyclables is functioning well (GUS, 2002; Podgajniak, 2002).

Sample selection

Respondents were selected by the Chief Statistical Office in Warsaw using the stratified random method. The random selection followed specific procedures and algorithms. As a result, a representative number of schools was obtained from each of the selected provinces, and an appropriate number of second grade pupils from gymnasiums (aged 14-15 years) and third graders from general lyceums (aged 18-19 years). Altogether 421 pupils from 20 selected gymnasiums (six from Malopolska, six from Mazovia, five from the Silesia and three from Warmia-Mazury) and 613 pupils from 22 general lyceums (four from Malopolska, seven from Mazovia, seven from Silesia and four from the Warmia-Mazury) were selected.

Methodology and statistical analysis of the results

In this study, questionnaires were specially prepared for target respondent groups. The questionnaires contained different sets of questions for gymnasium and lyceum pupils. The group questionnaire method was used to select the pupils.

Statistical analysis was performed using SPSS software with weighting factors taking into account the actual number of learners at the individual education stages mentioned above, and in the provinces covered by the study.

One attitude component studied – knowledge – was investigated using a quantitative **index of environmental knowledge** consisting of two indices, one characterising knowledge regarding nature, and the other characterising environmental knowledge not regarding nature.

In order to explain the differences in knowledge by means of nominal variables, categories of indices were identified. The environmental knowledge index had a 0 to 12 scale. For purposes of analysis, the index was categorised as low (values below 4), medium (from 4 to 8), and high (values greater than 8).

The index of knowledge regarding nature was constructed on the basis of questions concerning the goals and consequences of establishing national parks, knowledge of names of protected plants and animals, and national parks (to achieve a maximum score, the lyceum pupils had to give five examples whereas the gymnasium pupils, three). Pupils were also asked to define the goal of rare species protection (gymnasium) or the term 'ecology' (lyceum).

The *index of environmental knowledge not concerning nature* comprised questions testing knowledge about waste and issues related to energy, natural resources and the greenhouse effect.

The scope of knowledge regarding waste comprised: the term recycling; examples of hazardous waste (for gymnasium and lyceum); and the most frequent methods of waste disposal in Poland (only for lyceum). To obtain the highest score, gymnasium pupils were required to indicate environmentally-friendly energy sources and lyceum pupils were expected to define the greenhouse effect and renewable energy sources and indicate an example. Each index had a 0 to 6 scale and three categories were identified: low (values below 3), medium (values of 3 or 4) and high (values of 5 or 6).

To investigate pupils' pro-environmental behaviour, factor analysis was used. This helped identify correlated types of behaviour. To assess to what extent the correlations obtained by this analysis result from the effect of 'common construct', the KMO coefficient (Keiser-Meyer-Olkin measure of sampling adequacy) was verified. Four groups of related actions were obtained and named. Next, the percentage of people declaring the performance of all actions within each group was identified along with the frequency of such actions.

Issues pertaining to partial knowledge (e.g. waste management, renewable energy sources, natural resources, protected plant species, protected animal species, names of national parks, reasons for establishing national parks and their effects) were correlated with sets of actions reflecting practical use of this information. Also, dependence was sought between pupils' sets of actions and indices of knowledge regarding the environment and nature, the region of pupils' residence and socio-economic variables.

To verify hypothetical relationships among the variables, cross-tabs were used and statistical tests relevant to the character of the variables, were conducted:

- *eta* (η) and eta square (η^2) to study the relationships between quantitative indices and nominal variables
- *Tau-b Kendall* (τ_b) and *Tau-c Kendall and Stuart* (τ_c) coefficients in the case of ordinal variables with a small number of categories
- *Goodman-Kruska's gamma coefficient* (γ) – in the case of ordinal variables with a large number of categories
- *d-Somer's D coefficient* - in the case of ordinal variables, to verify the direction of relationships
- *Spearman's rank correlation* (r_s) – when one of the ordinal variables was dichotomous.

Only those cross-tab relationships were described for which the coefficients specified above were greater than 0.2 (except for η^2) for significance levels $p < 0.05$.

Results and discussion

Pupils' knowledge of nature and the environment

The highest value for the environmental knowledge index (more than 8 points) was obtained by 51% of respondents whereas only 33% of respondents obtained a high value of the index of knowledge specifically related to nature. Pupils showed greatest knowledge of issues related to waste, energy, natural resources, and the greenhouse effect (the index of knowledge *not* related to nature): results better than 5 points were obtained by 60% of the pupils.

A trend was observed that gymnasium students obtained better average results, both in terms of the environmental knowledge index ($\eta^2 = 0.054$, $p < 0.05$) or its components, that is the index characterising knowledge regarding nature ($\eta^2 = 0.034$, $p < 0.05$) and not related to nature ($\eta^2 = 0.035$, $p < 0.05$) (Figures 1 and 2).

The factor that differentiated levels of knowledge, but only that pertaining to nature, was the province in which the respondents lived ($\eta^2 = 0.02$; $p < 0.05$). The best results were obtained by pupils from the Malopolska and Silesian Provinces. In both these provinces almost 60% of pupils knew the names of national parks, whereas in other provinces the percentage of those who had such good knowledge was lower by half. The situation with regard to the names of protected animals was similar: pupils with the best knowledge lived in the Malopolska (45%) and Silesian (42%) provinces ($r_s = -0.23$, $p < 0.05$).

These results may be caused by the fact that Silesia, as a region associated with the mining industry, is considerably transformed and polluted. After many years of living with the threat of loss of health, much emphasis is placed there on environmental education (Table 1). Why then do pupils of Malopolska, and not pupils of Warmia and Mazury, have high knowledge regarding nature if the percentage of protected areas is about the same in those provinces? This is probably due to the presence of exceptionally valuable natural areas, covered by the highest form of protection (national parks). Malopolska has as many as six national parks, which account for 2.5% of the province area – the largest proportion of all the provinces.

National parks are places where environmental education is provided, especially to children and young people. Teachers can organise classes in natural surroundings as part of their lessons, and benefit from the so-called educational paths marked in national parks. These results confirm the need to organise ecological education classes in the natural environment (Braund, 2004; Nowak, 2002; Watkins et al, 2000).

Warmia and Mazury are characterised by a considerable proportion of wasteland and their protected areas, although valuable in terms of their landscape, do not have as high a protection status as national parks. The region's problem is unemployment and slow economic development (Table 1). In contrast to Malopolska, it seems more justified to assume that in this region pupils' knowledge of nature depends more on their parents and their social status (an issue not directly examined by the questionnaire). A relationship between the pupils' average index of knowledge of nature and their parents' employment was found ($\eta^2 = 0.03$, $p < 0.05$). The greatest number of children with high indices of this knowledge come from families where both parents are employed.

Also, differences were found in the way knowledge depends on understanding the goals of species and habitat protection as well as the size of the respondent's place of residence. The highest scores were obtained by 43% of pupils from villages and small towns of less than 10,000 residents. In towns with more than 50,000 residents, only half that number of pupils had a similar level of knowledge. These results may confirm the thesis that pupils' contact with nature, which is easier in small towns and villages (especially in regions with valuable natural assets) can lead to the understanding of the need to protect nature (Burger, 2005).

Sources of pupils' knowledge about the environment

Another important issue was to discover the sources of pupils' knowledge about the environment and its protection (Figure 4). Pupils could select up to three answers. A similar pattern was noted for choices made by most gymnasium and lyceum pupils. The source most often mentioned was 'television'.

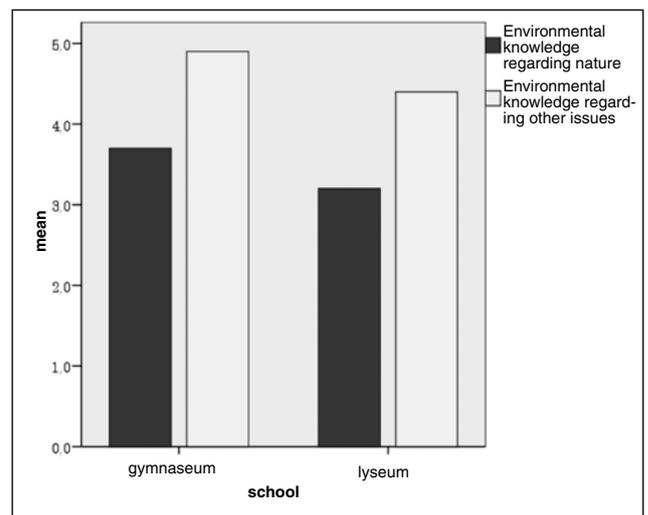


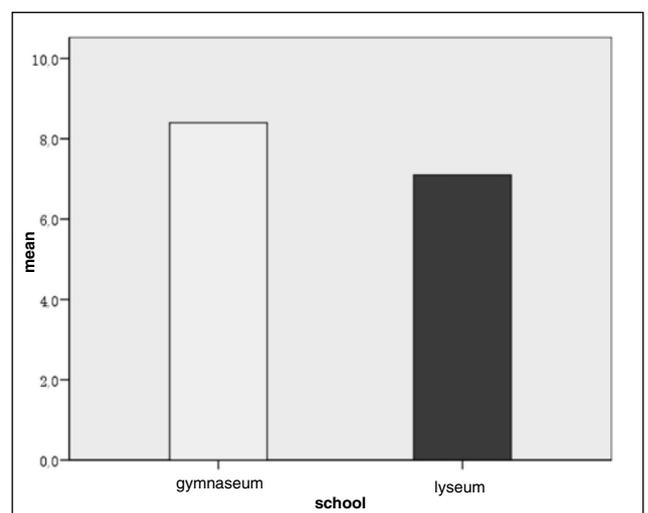
Figure 2. Differences in average knowledge indices (related to nature and not related to nature) among gymnasium and lyceum pupils.

The second important source mentioned was 'school and teachers' and the third one 'newspapers and magazines'. It is worrying that for most pupils school is not the main source of knowledge about the environment and only half of the respondents read specialised newspapers and magazines.

In the case of lyceum pupils, school as a place where environmental information is obtained becomes less important (the number of lyceum pupils picking out school is three times lower than that of gymnasium pupils), whereas their interest in specialised journals increases. An exception to this general trend was noted among pupils of a lyceum in Malopolska: they more often indicated specialised literature than school as a source of knowledge.

Whereas for gymnasium pupils family plays an important role in acquiring this knowledge (22% of indications), for lyceum pupils the opinions of their closest family matter the least (only 6.3% of indications), whereas their most important sources of knowledge regarding the environment are specialised books and films: these sources of information were, however, included only in the questionnaire for lyceum pupils (Figure 4). The differences between choices made by lyceum and gymnasium pupils may result from the psycho-social develop-

Figure 3. Differences in average environmental knowledge index among gymnasium and lyceum pupils.



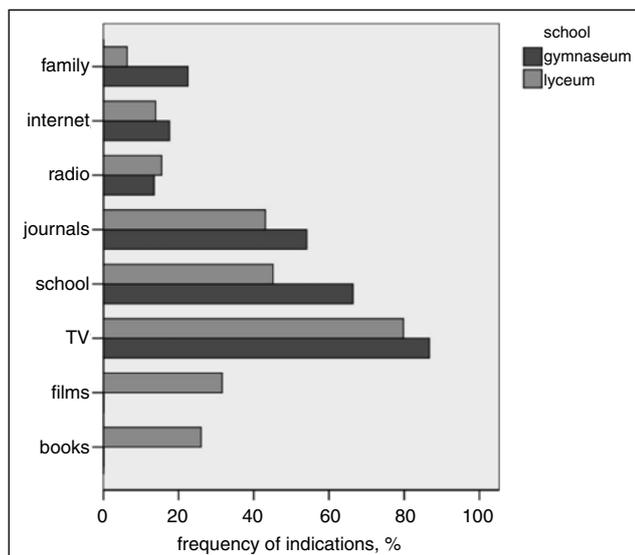


Figure 4. Sources of knowledge regarding nature reported by gymnasium and lyceum pupils.

ment of young people: as they grow up, the authority of their parents in matters of knowledge decreases (Anderson, 2005). Lyceum pupils, more often than their younger colleagues, acquire knowledge on their own and rarely rely on their family's knowledge concerning the environment. In this study, other mass media, such as the radio and the internet (with the exception of television), rank at the bottom of the list.

These results have been confirmed by other studies connected with the level of environmental education in Poland and many other countries (Potyrała et al, 2004, Bonnett and Williams, 1998; Chan, 1998; Filho, 1996; Rickinson, 2001 after Conell, 1998). The mass media are not considered a reliable source of information about the environment as they often distort knowledge and promote attitudes to the environment based on consumption (Rickinson, 2001 after Conell, 1998; Stawiński, 2002).

Pupils' environmental actions and behaviour

Analysis of the main components made it possible to identify the most correlated types of environmental behaviour, which can be treated as the effect of common factors (KMO=0.85).

The following groups of actions were identified:

- Segregation of recyclables, consisting of correlated statements: "I segregate and throw away in separate containers plastic waste (e.g. plastic beverage bottles), glass waste (e.g. glass beverage bottles), metal waste (e.g. beverage cans) and scrap paper (e.g. newspapers)";
- Active attitudes to nature and interest in the environment, which is composed of the following statements: "I watch programmes and films about nature", "I feed birds and other animals in winter", "I spend time in the open air (in the forest, park)", "I take part in pro-environmental actions";
- Raw material conservation, which is composed of the following statements: "I turn off the tap when brushing my teeth", "I turn off the light when leaving the room", "I avoid washing up in running water";
- Re-use of products, composed of the following declarations: "When taking notes, I write on both sides of the sheet", "I re-use products fit to be re-used (e.g. jars, shop-

ping bags, old newspapers)".

Segregation of recyclable materials was stated by 48% of all the pupils surveyed, whereas only 10% of them said that they performed these actions frequently. Recent studies in Poland have shown that more and more pupils see the importance of waste segregation (22%) (Potyrała et al, 2004). However, in the UK, a similar percentage of respondents considered waste to be a serious environmental problem as early as 1996 (Morris and Schagen, 1996).

Behaviour with regard to waste segregation is differentiated by place of residence (province and the type of housing). As many as 62% of Malopolska pupils declared that they segregate waste, whereas in the Warmian-Mazurian Province the percentage is almost half that (36%) ($\eta = 0,2$; $p < 0,05$). Of the people who live in single-family housing estates, 57% segregate waste, whereas only 33% of respondents living in blocks of flats do so ($\tau_c = 0,2$, $p < 0,05$). This has been confirmed by the studies conducted on a nationwide sample, which show that the readiness to participate in waste segregation is higher in places where the segregation system is better organised and the distance to the containers is shorter (CBOS, 2000).

The frequency of waste segregation declared by pupils and its dependence on the place of residence can result from differences in the development and organisation of waste management in a given province. Among the provinces under study, it is Malopolska that has the highest percentage of municipalities organising municipal waste segregation for its residents, and the highest number of relevant information and educational programmes (GUS, 2002).

As regards environmental activity and interest in the natural environment it is the domain of 46% of gymnasium and lyceum pupils, but only 4.5% declared that they do these things frequently. The occurrence of *environmental activity and interest* in the natural environment are related to the size of the pupils' place of residence ($\gamma = -0,25$, $p < 0,05$). In small towns (with less than 10,000 residents) such activity is reported by more respondents (53%) than in towns with more than 50,000 residents (37%). These results may confirm the thesis that the surroundings affect the intensity of environmental sensitivity. Environmental activity and interest in the natural environment are correlated with pro-environmental consumer choices. People who declare their involvement in such actions also declare that they pay attention to whether product packaging is recyclable, and they also choose reusable shopping bags (made of canvas, basketwork, etc).

Actions most often undertaken by pupils are those aimed at *product re-use* (87% of the respondents) and *conservation of natural resources* (62%). A considerable number perform all these actions on a regular basis (i.e. 'often' or 'very often'): 22% in the case of *conservation* and more than half (51%) in the case of *re-use*.

Comparing the environmental activities of Polish and English pupils at similar age, a similar picture emerges: 32% of Polish lyceum pupils (this study) and 30% of English pupils aged 17 declare that they segregate paper on a regular basis. Similarly, 74% of Polish pupils and 78% of English pupils declare that they conserve electricity (Morris and Schagen, 1996).

Pupils' knowledge and actions and their attitudes towards the environment

With an increase in knowledge about nature, there comes an increase in the number of pupils who say they abide by

the regulations in protected areas ($r_s=0.2$; $p<0,05$). The direction of the relationship between detailed environmental knowledge and the types of behaviour mentioned above was noted. The number of properly-named protected animal and plant species depends on factors based on contact with nature and an active attitude to it ($D=0.28$; $p<0.05$). This unexpected direction of the relationship raise the supposition that it is not knowledge, as in studies conducted by Posch (1993), Steel (1995), Morris and Schagen (1996), but rather contact with nature and the resulting sensitivity that plays a major role in acquiring knowledge and shaping proper environmental attitudes (Peterson, 1992; Sward and Marcinkowski, 2000; Tanner, 1980).

Understanding the purpose of environmental activity leads to more frequent participation: of those pupils who said they participated in such actions, 98% thought that these actions help them understand environmental issues. A similar opinion was expressed by more than 90% of pupils who stated that they participate in these actions often or very often. In Warmia and Mazury, the percentage of pupils with a proper attitude to such actions is the lowest, and as many as 31% of pupils from schools of that region declared that they did not take part in them, nor were they willing to do so in the future. In the other provinces the number of pupils with such a negative attitude was at least one third less.

Knowledge about alternative sources of energy does not coincide with behaviour oriented at conservation of natural resources. This type of behaviour is therefore assumed to be economically motivated.

Conclusions

- Pupils' basic environmental knowledge – required in gymnasium and lyceum within the environmental education track – was assessed: two-thirds of pupils had knowledge of environmental issues not connected with nature, such as waste segregation, natural resources, the greenhouse effect, etc, but only one-third of pupils revealed a knowledge of issues connected with nature. Gymnasium pupils scored better in both cases. It is thus necessary to familiarise pupils with the biodiversity of natural areas, regardless of the level of education, and this calls for live contact with nature, preferably in the natural environment. The results indicate that it is pupils living in the neighbourhood of protected or degraded areas who have the highest level of knowledge regarding nature. Also, the knowledge of protected animal and plant species depended on actions stemming from interest in, and contact with, nature. That is why, in line with the basic principles of the environmental education track, the local environment should be fully employed in planning environmental education at school level. The highest possible number of lessons should take place in the natural environment, especially given that teachers in Poland often underestimate the importance of such lessons.
- It seems worrying that the pupils surveyed mention school as only the second important source of environmental knowledge, after the mass media. Is the way schools convey knowledge about environmental protection not attractive enough or is it not appreciated by pupils? This information can indicate that knowledge should be conveyed by teachers in a more modern and active way, involving the use of television (indicating valuable programmes) as a very

efficient tool of ecological education, especially with regard to shaping patterns of behaviour and encouraging individual or collective actions for the benefit of the environment.

- Also, differences were demonstrated with regard to the importance of ways of obtaining information about the environment. It is lyceum pupils, in contrast to those at gymnasium, who more often indicate individual studies and specialised literature as sources of this knowledge. These differences set guidelines for better use of educational methods (e.g. to motivate pupils). A good method of working with lyceum pupils could be an environmental project based on the pupil's own search for information from various sources and contact with NGOs, local government and protected areas management bodies. In the case of gymnasium pupils, working in a group of peers and resorting to the assistance of relatives seems the most appropriate method.
- Less than half of all respondents take part in environmental activities that can be considered unselfish sacrifices (waste segregation, actions for the benefit of nature). Taking into account the frequencies of component actions, the results are no longer satisfactory. Actions for the benefit of the environment, which are undertaken by most of the respondents, are not necessarily motivated by the willingness to protect the environment and its resources (energy and water saving), as indicated by other Polish and foreign studies. This study has demonstrated that a high level of environmental knowledge and its components are not always accompanied by pro-environmental behaviour: however, detailed environmental knowledge is determined by pupils' behaviour concerning contact with nature. This conclusion emphasises the importance of the emotional factor (sensitivity) in shaping the appropriate attitude to the natural environment. The issue of what motivates people to undertake actions for the benefit of the environment deserves a deeper insight, e.g. as part of a qualitative study. From this, it will be possible to offer teachers a wider range of detailed methods for shaping their pupils' behaviour.

References

- Aronson E (1995) *The Social Animal* (7th ed). NY: W H Freeman.
- Bonnet M and Williams J (1998) Environmental education and primary children's attitudes towards nature and the environment. *Cambridge Journal of Education* 28, 159-174.
- Braund M (2004) Bridging work in science: what's in it for primary schools? *Primary Science Review* 82, 24-27.
- Buchcic E (2002) Teaching environmental education in the light of teachers' experience. Environmental Education – its principles and reality after the school reform. *Zeszyty Naukowe Komitetu „Człowiek i środowisko”* 31, 271-278.
- Burger T (2005) *Świadomość ekologiczna społeczeństwa polskiego*. Instytut Gospodarki Przestrzennej i Mieszkalnictwa. Warszawa
- Chan K W (1998) *Mass media and environmental cognition in Hong Kong*. NCA/ICA Conference Communication: organizing for the future. Roma.
- Cichy D (2003) *Szkola wobec wyzwań edukacji biologicznej i środowiskowej w XXI wieku*. Warszawa. IBE.
- Conell S, Fien J, Sykes H and Yencken D (1998) Young people and the environment in Australia: beliefs, knowledge, commitment and educational implications. *Australian Journal of Environmental Education* 14, 39-48.
- Domka L (2001) Dialog z przyrodą w edukacji dla ekorozwoju.

- Wydawnictwo Naukowe PWN. Warszawa – Poznań.
Dziennik Ustaw [Journal of Laws] z dnia 15 lutego 1999 r, nr 14, poz 128, Podstawa programowa kształcenia ogólnego dla liceów ogólnokształcących, liceów profilowanych i techników; nr 129
- Filho W L (1996) Eurosurvey: an analysis of current trends in environmental education in Europe, ed. G Harris, C Blackwell, *Environmental Education. Monitoring change in education*. Aldershot, Arena.
- Central Statistical Office (GUS) (2002) *Statistical Yearbook of The Regions*. Poland, Warsaw.
- Grodzińska-Jurczak M and Friedlein K (2001) Environmental knowledge and awareness in Polish secondary education. Gate to EHS, 1-4 (published online based on agreement with *Environmental Science & Pollution Research* in peer-reviewed Gate to EHS – Internet Journal on Environmental & Health Science).
- Mongensen F (2003) *Environmental Education – development and evaluation*. Research Center for Environmental and Health Education. Copenhagen. The Royal Danish School of Education Studies.
- Morris M and Schagen I (1996) *Green attitudes or learned responses?* National Foundation for Education Research. Berkshire.
- Nowak L (2002) Field activities as a form of environmental education of the third stage of education. Environmental Education – its principles and reality after the school reform. *Zeszyty Naukowe Komitetu „Człowiek i środowisko”* 31, 179-187.
- Palmer J, Suggate J, Bajd B, Hart P, Ho R, Ofwono-orecho J, Peries M, Robottom I, Tsaliki E and Christie V (1998) An Overview of Significant Influences and Formative Experiences on the Development of Adults' Awareness in Nine Countries. *Environmental Education Research* 4, 4, 445-464.
- Podgajniak T (Ed) (2002) *Agenda 21: 10 years after Rio*. Narodowa Fundacja Ochrony Środowiska, Warszawa.
- Posch P (1993) The Environment and School Initiatives (ENSI) I: action research in environmental education. *Educational Action Research* 1, 3, 447-86.
- Potyrała K, Walosik A and Kuczek I (2004) Kształtowanie postaw uczniów liceum ogólnokształcącego podczas realizacji projektu “Ostoja Przyrody”. *Edukacja Biologiczna i Środowiskowa* 2-3 (10-11), 163-168.
- Rickinson M (2001) Learners and Learning in Environmental Education: a critical review of the evidence. *Environmental Education Research* 7, 1-320.
- Steel B S (1995) Thinking Globally and Acting Locally? Environmental Attitudes, Behavior and Activism. *Journal of Environmental Management* 47, 27-36.
- Stawiński W (2002) The measurement and assessment of the results of environmental education. Environmental education – curriculum, methods, effects. *Zeszyty Naukowe Komitetu „Człowiek i środowisko”* 28, 30-42.
- Stoczkowska R (2002a) Reform of education and changes in environmental teaching at the primary-school level. Environmental education – curriculum, methods, effects. *Zeszyty Naukowe Komitetu „Człowiek i środowisko”* 28, 169-175.
- Stoczkowska R (2002b) Introducing and documentation of ecological path in primary school, Environmental Education – its principles and reality after the school reform. *Zeszyty Naukowe Komitetu „Człowiek i środowisko”* 31, 117-123.
- Sward D, Marcinkowski T (2000) Environmental sensitivity: A review of the literature: 1980-1998. In: Hungerford H R (Ed) *Essential Readings in Environmental Education*. Champaign, IL: Stipes.
- Tanner T (1980) Significant life experiences: A new research area in environmental education. *Journal of Environmental Education* 11, 20-24.
- The Public Opinion Research Center (CBOS) (2000) *The ecological awareness of Poles*. Research reports.
- Watkins C, Wagner P, Carnell E, Lodge C and Whalley C (2000) *Learning about Learning: Resources for Supporting Effective Learning*, London, Routledge.

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