



ENVIRONMENTAL LITERACY OF ISCED 2 PUPILS IN POLAND

SILVIE SVOBODOVÁ

Potrjeno/Accepted

23. 9. 2022

Objavljeno/Published

22. 3. 2023

Faculty of Science, Purkyně University in Ústí nad Labem; Department of Biology and Environmental Studies, Faculty of Education, Charles University, Prague, Czech Republic

KORISPONDENČNI AVTOR/CORRESPONDING AUTHOR/

silviesvobodova74@seznam.cz

Abstract/Izveček

Environmental literacy comprises environmental knowledge, attitudes, sensitivity, and responsible environmental behaviour. This study focuses on the environmental literacy of ISCED 2 pupils in Poland. The survey analysed the relationship between environmental literacy and its significant determinants. The connection between environmental literacy and the gender, school grade and leisure time of the respondents was determined. More than three hundred respondents took part in the testing. A moderately positive relationship between the dimensions of environmental literacy was demonstrated. Analyses have also shown that environmental literacy is significantly determined by gender, school grade and leisure activities, especially outdoor activities.

Keywords:

environmental literacy, determinants, ISCED 2, authorial analytic instrument, Poland

Okoljska pismenost poljskih učencev na predmetni stopnji

Okoljska pismenost predstavlja obseg okoljskega znanja, stališč, občutljivosti in odgovornega okoljskega vedenja. Predstavljena študija se osredinja na okoljsko pismenost učencev na predmetni stopnji na Poljskem (angl. International Standard Classification of Education – ISCED 2). Raziskava je analizirala povezavo med okoljsko pismenostjo in njenimi pomembnimi dejavniki. Ugotovljena je bila povezava med okoljsko pismenostjo in spolom, šolsko stopnjo in prostim časom anketiranih. V testiranju je sodelovalo več kot tristo anketiranih. Pokazala se je zmerena pozitivna povezava med razsežnostmi okoljske pismenosti. Analize so tudi pokazale, da okoljsko pismenost pomembno določajo spol, razred šole in pristočasne dejavnosti, zlasti dejavnosti na prostem.

Ključne besede:

okoljska pismenost, determinante, ISCED 2, avtorsko analitično orodje, Poljska

UDK/UDC:

37.015.31:502/504

DOI <https://doi.org/10.18690/rei.1665>

Besedilo / Text © 2023 Avtor(ji) / The Author(s)

To delo je objavljeno pod licenco Creative Commons CC BY Priznanje avtorstva 4.0 Mednarodna.

Uporabnikom je dovoljeno tako nekomercialno kot tudi komercialno reproduciranje, distribuiranje, dajanje v najem, javna priobčitev in predelava avtorskega dela, pod pogojem, da navedejo avtorja izvirnega dela. (<https://creativecommons.org/licenses/by/4.0/>).



University of Maribor Press

Introduction

The concept of the construct of environmental literacy was formed over time in a close reciprocal relationship with the development of environmental education. In documents from the North American Association for Environmental Education, it is also characterized as the main goal of environmental education, covering its framework goals comprehensively (NAAEE, 2019). The applied research tool is based on the above definition of environmental literacy, although the Polish concept of environmental education does not explicitly work with this concept.

The best known research tools for environmental literacy include the 2 Major Environmental Values (2-MEV) scale (Johnson and Manoli, 2011) and the Middle School Environmental Literacy Survey (MSELS) (McBeth and Volk, 2010). The questionnaire in the present study is an analytical tool developed by the author based on these previous tools.

Testing the environmental literacy of ISCED level 2 pupils in Poland was part of a larger study aimed at determining the level of environmental literacy in the Czech Republic, Slovakia, Poland, Germany, and Austria.

Theoretical background

Environmental education

The field of environmental education itself was first defined and specified at the end of the 1960s and the start of the 1970s. Its goals were officially formulated in Tbilisi in 1977. Its main goal was based on the acquisition of a complex of knowledge and skills, continuous consolidation and development of the ability to think in context (Roth, 1992).

Based on a certain generalization and comparison of selected key paradigms, the development of environmental education can be summarized in three paradigmatic models. In the 1970s, the main interest among experts was environmental awareness, with an emphasis on knowledge of nature and environmental issues focused on nature. The second model, which is characterized in NAAEE documents, was formed mainly in the USA. It focuses on responsible environmental behaviour through conflict investigation skills: as well as nature, it also targets society.

The third model, or the Northern European approach, aims at society, and its objective is to motivate people towards analysis of and participation in the resolution of environmental conflicts. Action competences for resolving problems that reflect relevant qualitative research are considered indispensable (Činčera, 2013).

Research into Environmental Literacy

Environmental literacy is based mainly on the principles of environmental education, and as would be expected, this represents its fundamental goal (Roth, 1992). It is currently perceived as a concept encompassing all the framework goals of environmental education (NAAEE, 2019).

Many experts favour the concept based on documents from the North American Association for Environmental Education (NAAEE). In these, the construct of environmental literacy is stated as a key goal of environmental education, comprehensively covering its framework goals (NAAEE, 2019).

A number of researchers have been involved in environmental literacy testing abroad. However, research that takes a comprehensive approach to it is an exception on a global scale (e. g., McBeth and Volk, 2010; Nastoulas et al., 2017). When mapping and analysing environmental literacy, many studies focus mainly on the affective dimension (e.g., Bogner et al., 2015; Grůňová et al., 2018), or the cognitive (e. g., Gul and Yesilyurt, 2011), sometimes in combination with the affective (e. g., Ilhami et al., 2019). The conative dimension, however, is not given much attention, although some research has focused on creating models of responsible environmental behaviour (e. g., Heimlich and Ardoin, 2008), or identifying the variables that shape it (e. g., Osbaldiston and Schott, 2012). However, recently there has been an effort to focus studies on the analysis of responsible environmental behaviour (e. g., Osbaldiston and Schott, 2012; Whitburn et al., 2020).

The absence of comprehensive environmental literacy research with a large sample of respondents was among the key arguments for conducting nation-wide environmental literacy research with high school students in the US at ISCED level 2 (The National Environmental Literacy Project) (McBeth and Volk, 2010). To this end, the Middle School Environmental Literacy Survey (MSELS) analytical tool was developed. It comprises a scale whose ambition is to cover all dimensions of environmental literacy. The tool was successfully validated not only in the American context (McBeth and Volk, 2010), but also in the Greek (Nastoulas et al., 2017) and the Czech environments (Svobodová and Kroufek, 2018).

In the case of ISCED 2 pupils, research often specifically focuses on certain components of environmental literacy, the interrelationship between them and their interaction with other variables. Ilhami et al. (2019) consider the implementation of natural science teaching in the context of local natural environment and traditions to be an effective method for strengthening environmental literacy. Schumm and Bogner (2016) used a didactic test to determine knowledge and the relationship between knowledge and gender. They concluded that gender specifics should be taken into account when designing environmental education programmes, as each gender responds differently to different aspects, many of which are crucial for learning.

Bogner et al. (2015) and Grúňová et al. (2018) focused on the affective dimension of environmental literacy and the diagnosis of its relation to demographic variables (gender, age, school grade, etc.). The significant influence of age on pro-environmental attitudes has been demonstrated, for example, by Bogner et al. (2015), and the correlation was negative. Grúňová et al. (2018) did not confirm the influence of age or gender. Similarly, Nastoulas et al. (2017) did not note a relationship between attitudes and gender among Greek students. Negative relationships between students' attitudes and their school grade have also often been demonstrated (e. g., McBeth and Volk, 2010; Nastoulas et al., 2017). Leisure activities can also be considered fundamental predictors of environmental attitudes and sensitivities, in combination with gender or school grade. A positive relationship was found between these, for example, by Geng et al. (2015) and Pereira and Forster (2015).

Geng et al. (2015), Pereira and Forster (2015), and Whitburn et al. (2020) focused on the relationship between nature and the conative dimension, i.e., areas of responsible environmental behaviour. They came to the same conclusions about the positive impact of regular activities associated with spending time in the outdoors not only on attitudes, but also on responsible environmental behaviour. In their study, Whitburn et al. (2020) support the view that the feeling of close connection with nature positively influences an individual's approach to it and increases positive consequences regarding general nature protection and biodiversity.

Environmental education and literacy in Poland

In Poland, the development of environmental education was initially similar to that in the Czech Republic. Its concept was based on a paradigmatic framework, which corresponded to the understanding of the field in the 1970s, taken from KAB theory (knowledge-attitudes-behaviour). The focus was on knowledge about nature, and the core responsibility lay in the hands of biology teachers, who passed on knowledge and shaped attitudes (Ramsey and Rickson, 1976). Until the end of the 20th century, formal environmental education was implemented mainly in biology classes or in the form of extracurricular and leisure activities. Initially, special emphasis was placed on the acquisition of knowledge about environmental protection. The subsequent reform of the education system was based on the implementation of multi-faceted education focused on practical knowledge (Buchcic, 2002; Kobiarska et al., 2007).

As part of official environmental education, an interdisciplinary subject on nature was included in the basic curriculum, and new methods of teaching about the environment and ecology were applied. Environmental education is implemented either through integrated topics on the protection of nature or in the form of separate model programmes. The main goal of environmental education is to develop students' personal responsibility for the quality of the environment. Teaching is aimed at resolving environmental problems at the local and regional level. However, some studies point to the ambiguity and unsystematic nature of legal provisions and of the implementation of environmental education. Overly general recommendations, for example, for the selection of appropriate educational programmes, can result in significant inconsistencies in pupils' knowledge and skills across different schools in and regions of Poland (Stoczkowska, 2002).

Only a few researchers study pupils' pro-environmental attitudes. Their approaches are often inconsistent, especially with regard to the definition of the concept and methodology (Burger, 2005). Research conducted in the 1990s focused only on environmental knowledge and awareness of environmental threats. It revealed considerable inconsistency in knowledge (Domka, 2001). At the beginning of the 21st century, the emphasis is on an active approach to environmental issues, and the importance of pupils' views and attitudes is emphasised (Potyrała et al., 2004). The pro-environmental attitudes of Polish pupils were analysed by Kobiarska et al. (2007), focusing on knowledge about the environment and activities for the benefit of nature, as defined in the environmental education curriculum.

Pupils were shown to have quite good knowledge about anthropogenic environmental issues, but less awareness of nature issues. A positive connection with spending time in the natural environment was recorded.

Aim and research questions

The Research Ethics Committee of Faculty of Education, Charles University found that the study carried out within the project Environmental Literacy of Second Grade's Pupils at Primary School in the Czech Republic, Slovakia, Poland and Germany met the requirements for ethical research practices.

The aims of this part of the research were to analyse the environmental literacy of pupils at ISCED level 2 in Poland and to identify the relationship between literacy and selected variables through an analytical tool developed by the author.

For the purposes of the research and the fulfilment of its goals, the following research questions were established:

1. What is the connection between the cognitive, affective and conative dimensions of the environmental literacy of ISCED level 2 pupils in Poland?
2. How close is the relationship between the variables (gender, school grade, and leisure activities) and the individual dimensions of the environmental literacy of ISCED level 2 pupils in Poland?

The following hypotheses were derived and formulated from the research questions, inspired by the findings from studying analogous research:

H1: Girls will demonstrably achieve higher values of cognitive, affective and conative dimensions of environmental literacy than boys.

H2: The values of environmental knowledge will increase in higher ISCED level 2 school grades.

H3: The values of the affective and conative dimensions of environmental literacy will decrease in higher ISCED level 2 school grades.

H4: Leisure activities demonstrably predict the level of environmental literacy of ISCED level 2 pupils.

Methodology

Research tool

The applied analytical tool, a quantitative questionnaire, is based on the standard instruments MSELs and 2-MEV, and its construction covers all dimensions of environmental literacy in accordance with the current definition by NAAEE (2019). The tool was piloted in the Czech environment (Svobodová and Chvál, 2019) and consists of five parts. In part A. Demographic data, the pupil's age, school grade, gender and leisure activities are ascertained. Part B., Knowledge about nature (Knowledge scale), is a didactic test, a modified version of the MSELs tool scale (16 items). Part C., What do you think about nature and the environment? (Attitudes scale), targets environmental attitudes and consists of the 2-MEV tool (16 items). The scale was still treated as one-dimensional; the individual factors Preservation and Utilization were not evaluated separately. An opposite concept of factors was ensured by the opposite scoring of the answers. Part D., How do you feel about nature and the environment? (Sensitivity scale), was taken from the MSELs tool (9 items). The scale focuses on the feelings that respondents experience towards nature, and on their motivation for and interest in being in the natural environment. Part E., What you do for nature and the environment (Behaviour scale), consisting of 9 items and developed by the author, represents a scale focused on responsible environmental behaviour.

For the Knowledge scale, respondents always chose 1 correct answer from 4 options. The correct answer was assigned a value of 1. For the other scales, respondents agreed with an assertion on a five-point Likert scale. Responses were scored from 5 (positive response) to 1 (negative response). Some items were formulated in reverse; for the purposes of analysis, their polarity was reversed. Items for leisure activities (outdoor activities, ICT, hobbies and sports) were evaluated in a similar way from 5 (very often) to 1 (never).

The instrument was translated into Polish by a native speaker and a Polish-speaking academic member of staff at the Department of Psychology of the Pomeranian Academy in Słupsk and was checked by several Polish experts to highlight the cultural aspects of the Polish environment (see Appendix). The distribution of questionnaires in paper form took place to individual schools either in person or through an instructed contact person. First, the informed consent of the parents of the pupils involved was obtained.

The instructions to students were provided by the author in person or by a teacher familiar with the procedure, requirements and goals of the research. Informed consent for their participation in the research was obtained from the pupils' legal representatives. The administration of the questionnaire took about 30 minutes and was most often carried out during science lessons. At the beginning, the pupils were informed about the aims of the research, they were instructed how to fill in the questionnaire and were told that they were answering anonymously.

Data processing

The reliability of the subscales of the instrument was determined by calculating the internal consistency with Cronbach's coefficient α , including their item analysis. A difficulty index, ULI sensitivity coefficient and distractor analysis were set for the Knowledge scale. The significance of the relationship between the individual dimensions of environmental literacy, the subscales of the tool, was analysed using correlation analysis. In the case of gender, a two-sample t-test was used for independent sampling of groups, and correlation analysis was used for school grade and leisure activities. For knowledge, ANOVA was applied to compare the results between school grades, with knowledge representing the dependent variable and school grade the factor variable over four groups (6th - 9th grades of lower secondary school) across schools. Leisure activities were subjected to multiple linear regressions. Knowledge, attitudes, sensitivity, and behaviour figure in the analyses as dependent variables, while leisure activities (outdoor activities, ICT, hobbies and sport), gender and school grade are in the position of independent variables (AERA, APA & NCME, 2014).

Data collection

The questionnaires were distributed in Poland in the spring of 2019. The survey involved 371 respondents, 184 girls and 187 boys, from 4 lower secondary schools (two in Slupsk and two in Poznań). Information about the participants' school grades is shown in Table 1.

Table 1: Overview of the representation of respondents ($n = 371$) in the 6th to 9th grades of lower secondary school

Grade	Number of respondents	Percentage from the grade (%)
6.	90	24%
7.	123	33%
8.	87	24%
9.	71	19%

Results

The reliability of the instrument scales determined by calculating Cronbach's α coefficient showed sufficient values (Tavakol and Dennick, 2011). Item analyses identified 14 and 49 as suspicious items (see below), the removal of which increased the reliability of the affected Knowledge and Behaviour scales. The resulting reliability values for the instrument scales, including the original values and an overview of deleted items, are shown in Table 2.

Table 2: Overview of the calculated reliability of the partial scales of the author's instrument based on item analysis, including original values (Cronbach's α) found by the authors of the initial tools MSELS and 2-MEV

Tool scales	Reliability of Cronbach's α	Omitted items	Reliability without omitted items	Original reliability of Cronbach's α
Knowledge	.70	č. 14	.72	.79*
Attitudes	.73	-	.73	.83**
Sensitivity	.77	-	.77	.78*
Behaviour	.75	č. 49	.77	-

*MSELS - Middle School Environmental Literacy Survey (McBeth and Volk, 2010), **2-MEV - 2 Major Environmental Values (Johnson and Manoli, 2011)

Knowledge Scale

14. The original source of energy for almost all living things is:
- the soil
 - water
 - the sun
 - plants

14. Pierwotnym źródłem energii dla niemal wszystkich istot żywych jest:
- gleba
 - woda
 - słońce
 - rośliny

Behaviour Scale

49. I am not interested in air pollution problems.

- a) strongly agree b) slightly agree c) neutral d) slightly disagree e) strongly disagree

49. *Nie interesują mnie problemy związane z zanieczyszczeniem powietrza.*

- a) *zdecydowanie się zgadzam* b) *raczej się zgadzam* c) *nie mam zdania* d) *raczej się nie zgadzam*
e) *zdecydowanie się nie zgadzam*

The difficulty index of the Knowledge scale, i.e., the didactic text, was a very suitable $P= 58$. The difficulty index, ULI sensitivity coefficient and analysis of distractors of individual items agreed with the item analysis on problematic item No. 14 (see above), which showed structural deficiencies. Its difficulty index ($P= 34$) and sensitivity coefficient ($d= .04$) were low. The results of the analysis of distractors of this item also pointed to other weaknesses, which are presented in Table 3. The analysis of distractors shows that the respondents more often chose variant B as the correct answer, although these were less successful respondents when looking at the overall test result. The attractiveness of the correct answer (C) is significantly lower than that of one of the distractors (B); the discrimination of the given distractor attains a negative value. The cause of the problem could be related, for example, to an incorrect interpretation of the concept of energy in relation to water and the Sun as its source.

Table 3: Analysis of distractors of item No. 14 from the *Knowledge* scale

Possible answer	Attractivity (%)	Discriminance (1/5) (%)
A	4.0	-8.1
B**	55.0	-14.9
C*	33.7	25.7
D	6.7	-1.4

*C - correct answer, **problematic distractor

The correlation between attitudes, sensitivity, and behaviour, i.e., the affective and conative dimensions of environmental literacy, was identified by correlation analysis as significant, positive and moderately strong. The correlation coefficient ρ is in the interval $\langle .4; .6 \rangle$. For knowledge, a more fundamental connection with attitudes was noted ($\rho = .27$). The results of the correlation analysis are presented in Table 4.

Table 4: Overview of Spearman's correlations (values of correlation coefficients ρ) between sub-scales of the author's instrument, including correlations of individual scales with the instrument

Scales/tool	TOOL	Knowledge	Attitudes	Sensitivity	Behaviour
TOOL		.32	.86	.64	.83
Knowledge	.32		.27	-.04	.06
Attitudes	.86	.27		.37	.60
Sensitivity	.64	-.04	.37		.60
Behaviour	.83	.06	.60	.60	

Note: Values in bold are significant ($p < .01$)

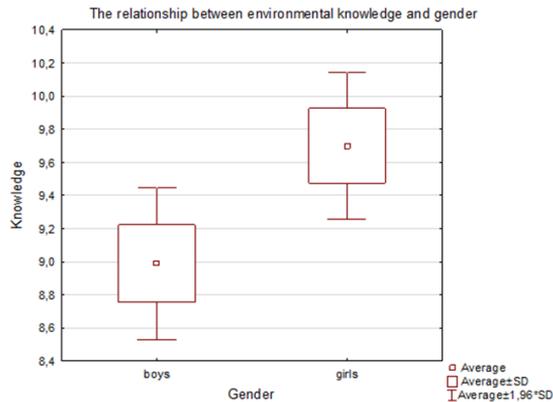
The descriptive characteristics of the sub-scales of the instrument, which represent the dimensions of environmental literacy, are presented in Table 5.

Table 5: Descriptive statistics (overview of basic results of sub-scales of the instrument)

Tool scales	Descriptive statistics of variables						
	number of items	n valid	min.	average	median	max.	SD
Knowledge	16	371	2,00	9,34	9,00	16,00	3,16
Attitudes	16	370	1,69	3,38	3,38	4,81	0,58
Sensitivity	9	370	1,56	3,15	3,11	5,00	0,69
Behaviour	9	368	1,00	3,46	3,44	5,00	0,67

Relationship between environmental literacy and gender

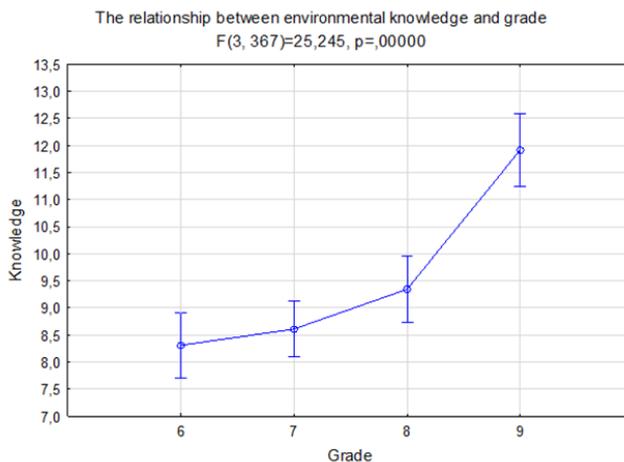
In the case of gender, a significant link to knowledge ($p < .05$), attitudes ($p < .001$) and behaviour ($p < .001$) was identified. Girls always achieved slightly higher values, as Graph 1 illustrates for environmental knowledge.



Graph 1: Relationship between environmental knowledge (author's instrument Knowledge scale) and gender of respondents based on the results of a two-sample t-test

Connection between environmental literacy and school grade or age

ANOVA demonstrated a significant association between knowledge and school grade (see Graph 2, $p < .001$). The results point to the fact that one of the school grades differs from the others. Tukey's HSD test showed a significant difference between the 9th grade and other grades ($p < .001$). Graph 2 shows the direct relationship between the level of knowledge and the school grade.



Graph 2: Relationship between environmental knowledge (author's instrument Knowledge scale) and the school grade of school-aged respondents based on ANOVA and Tukey's HSD test

However, ANOVA did not provide meaningful results for attitudes, sensitivity or behaviour, and correlation analysis was again used. Spearman's correlation coefficient proved to be statistically significant only in the case of knowledge ($\rho=0.37$). The values for the other instrument scales were not significant ($p > .05$).

The connection between environmental literacy and leisure activities

Testing of the relationship between leisure activities (outdoor activities, ICT, hobbies, sports) and environmental literacy was subjected to correlation analysis. A positive correlation was found between attitudes, sensitivity, and behaviour with leisure activities, except for ICT, although it was mostly a weak correlation. Only outdoor activities correlated more strongly with sensitivity and behaviour. In contrast, spending time with ICT proved to be a negative factor; the correlation coefficient reached negative values, which can be read in Table 6.

Table 6: Overview of mutual Spearman's correlations (correlation coefficient ρ) between the partial scales of the author's instrument and the individual leisure activities of respondents

Tool scales	Leisure activities			
	outdoor activities	ICT	hobbies	sport
Knowledge	-.10	-.04	.07	-.12
Attitudes	.14	-.25	.20	.05
Sensitivity	.36	-.17	.24	.24
Behaviour	.30	-.21	.14	.06

Note: Values in bold are significant ($p < .01$)

A weak connection between environmental literacy and leisure activities is also evidenced by the results of the regression analysis, i.e., the values of the regression coefficient and the coefficient of determination R^2 (see Table 7). Leisure activities predict knowledge by 5%, attitudes by 10%, sensitivity by 17% and behaviour by 12%. Outdoor activity, unlike ICT, has a positive effect and is the strongest of the leisure activities.

Table 7: Results of multiple regression analysis between the sub-scales of the author's instrument and the individual leisure activities of respondents

Tool scales	R ² Coefficient of determination	b - Regression coefficient			
		outdoor activities	ICT	hobbies	sport
Knowledge	.05	-.108*	-.054	.163**	-.160**
Attitudes	.10	.080	-.225***	.199***	-.045
Sensitivity	.17	.285***	-.110*	.130*	.122*
Behaviour	.12	.255***	-.162**	.102	-.042

* $p < .05$; ** $p < .01$; *** $p < .001$

Discussion

Environmental literacy research was carried out in Poland on a small sample of respondents ($n = 371$) and a small number of schools (4), so the results cannot be generalized for the whole target group of ISCED level 2 pupils in Poland because of the unrepresentativeness of the sample.

The relationship between environmental literacy dimensions was identified as significant. In particular, the affective and conative dimensions correlated moderately closely and positively (.4; .6). In the case of the cognitive dimension, there was a connection exclusively between knowledge and attitudes. Therefore, individuals with pro-environmental attitudes and high levels of environmental sensitivity can be expected to act in an environmentally responsible manner. The connections between the knowledge and attitudes of Polish pupils were examined in more detail by Kobierska et al. (2007). Several research studies address the issue of the relationship between the individual dimensions of environmental literacy. A significant relationship between the affective and conative dimensions was identified, for example, by Whitburn et al. (2020), while a connection with the cognitive dimension was not demonstrated. Analogous conclusions are provided by many other studies (Svobodová, 2020).

From the tested variables (gender, school grade and leisure activities), a significant connection of gender with knowledge, attitudes and behaviour was found, while for school grade, it was only with knowledge. In the case of leisure activities, there was a significant relationship with all scales of the instrument; however, the established link can be assessed as rather weak.

Hypothesis H1 (Girls will demonstrably achieve higher values of cognitive, affective and conative dimensions of environmental literacy than boys.) can be considered to have been proven, because girls showed higher values in knowledge, attitudes and behaviour. Schumm and Bogner (2016), for example, pointed to the fundamental relationship between gender and knowledge. They consider the gender aspect to be one of the decisive factors for learning and recommend that it be taken into account when creating environmental education programmes. Identical findings with respect to the statistically significant relationship between the gender variable and the affective dimension of environmental literacy were recorded, for example, by Kroufek et al. (2015). In contrast, Nastoulas et al. (2017) and Grúňová et al. (2018) did not confirm the effect of gender.

Hypothesis H2 (The values of environmental knowledge will increase in higher ISCED level 2 school grades.) was also confirmed, because the respondents' knowledge grew in direct proportion to their grade. Domka (2001), for example, drew attention to the non-uniform knowledge of Polish pupils. Evidence of a direct relationship between grade and knowledge is provided by other studies (e.g., McBeth and Volk, 2010). On the other hand, hypothesis H3 (The values of the affective and conative dimensions of environmental literacy will decrease in higher ISCED level 2 school grades.) cannot be considered to have been proven, because the connection between school grade and attitudes, sensitivity or behaviour did not prove significant. Findings about the negative correlation of school grade with attitudes, sensitivity or behaviour were reached, for example, by McBeth and Volk (2010) among American students, and Nastoulas et al. (2017) among Greek students. The same conclusions were reached by Liefländer and Bogner (2014) and Bogner et al. (2015), who applied the 2-MEV tool in their research.

Regression analysis confirmed hypothesis H4 (Leisure activities demonstrably predict the level of environmental literacy of ISCED level 2 pupils.). Although the identified relationship can be considered statistically significant, it represents a weak dependence. Nevertheless, to some extent leisure activities can be considered predictors of environmental knowledge, attitudes, sensitivity and responsible environmental behaviour, and outdoor activities can be considered as a positive determinant, in contrast to the negative factor of ICT. In their research in Poland, Kobierska et al. (2007) concluded that there was a positive connection between spending time regularly in the outdoors and environmental attitudes.

Many other research papers provide evidence on the positive and strong relationship between activities associated with outdoor activity and environmental literacy or rather attitudes, sensitivities and responsible environmental behaviour (e.g., Geng et al., 2015; Pereira and Forster, 2015; Činčera et al., 2020). The positive impact of the Ecoschool program, which is preferred by outdoor teaching, on pupils' environmental attitudes is reported, for example, by Potočnik et al. (2010). Similarly, Čagran et al. (2011) talk about the significant positive impact of project and experiential teaching.

Conclusion

The findings of the research confirm the relatively important relationships between environmental attitudes, sensitivity, and behaviour among Polish pupils. The results showed that attitudes and sensitivity can be considered essential determinants of responsible environmental behaviour. Similarly, outdoor activity, which shapes these attitudes and sensitivities, proved to be an important factor. The difference in values between girls and boys indicates the further significant influence of gender. As well as considering the gender aspect, it also seems crucial to emphasise the development of environmental sensitivity and attitudes, which are relatively strongly predicted by outdoor activities. The outdoor form of education appears to be an effective way of implementing environmental education. Of all the organised forms of teaching, it would be appropriate to regularly include field learning, inquiry-based science education, excursions, or various environmentally oriented projects. Experiential learning also offers considerable potential in this sense (Parry and Allison, 2019). Another important challenge is to identify the determinants and predictors of environmental literacy levels. Therefore, in further research, it would be appropriate to broaden the spectrum of variables and test their relation to environmental literacy, especially to environmental sensitivity and attitudes. However, given the low number of respondents and the non-representative nature of the sample, these research results cannot be unambiguously generalised for the entire target group of Polish pupils at ISCED level 2.

Limits of the study

The limitation of this research is primarily the small research sample and the method of respondent selection, as the respondents were not randomly selected. The respondents came from only 4 schools in two Polish cities, and the results cannot therefore be generalized to the whole target group of lower-secondary pupils in Poland.

Declaration of conflict of interest

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- AERA, APA & NCME (2014). *Standards for Educational and Psychological Testing*. Washington, DC: American Educational Research Association.
- Bogner, F. X., Johnson, B., Buxner, S., and Felix, L. (2015). The 2-MEV model: Constancy of adolescent environmental values within an 8-year time frame. *International Journal of Science Education*, 37(12), 1938–1952. <https://doi.org/10.1080/09500693.2015.1058988>
- 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). *Swiadomosc ekologiczna społeczenstwa polskiego*. Warszawa: Instytut Gospodarki Przestrzennej i Mieszkalnictwa.
- Čagran B., Sadek L., and Ivanuš Grmek, M. (2011). Eksperimentalno preverjanje učinkov projektnega pouka pri predmetu spoznavanje okolja. *Journal of Elementary Education*, 4(1/2), 5–22. <https://journals.um.si/index.php/education/article/view/310>
- Činčera, J. (2013). Paradigmatická proměna domácího pojetí environmentální výchovy. *Pedagogika*, 62(2), 182–197.
- Činčera, J., Johnson, B., Kroufek, R., and Šimonová, P. (2020). Values Education in Outdoor Environmental Education Programs from the Perspective of Practitioners. *Sustainability*, 12(11). <https://doi.org/10.3390/su12114700>
- Domka, L. (2001). *Dialog z przyroda w edukacji dla ekorozwoju*. Warszawa – Poznań: Wydawnictwo Naukowe PWN.
- Geng, L., Xu, J., Ye, L., Zhou, W., and Zhou, K. (2015). Connections with Nature and Environmental Behaviors. *PLoS One*, 10(5). <https://doi.org/doi.org/10.1371/journal.pone.012724>
- Grůňová, M., Sané, M., Činčera, J., Kroufek, R., and Hejčmanová, P. (2018). Reliability of the new environmental paradigm for analysing the environmental attitudes of Senegalese pupils in the context of conservation education projects. *Environmental Education Research*, 25(2), 211–221. <https://doi.org/10.1080/13504622.2018.1428942>
- Gul, S., and Yesilyurt, S. (2011). A Study on Primary and Secondary School Students' Misconceptions about Greenhouse Effect (Erzurum Sampling). *International Electronic Journal of Environmental Education*, 1(3), 193–202.

- Heimlich, J. E., and Ardoin, N. M. (2008). Understanding behavior to understand behavior change: a literature review. *Environmental Education Research*, 14(3), 215–237. <https://doi.org/10.1080/13504620802148881>
- Ilhami, A., Riandi, R., and Sriyati, S. (2019). Implementation of science learning with local wisdom approach toward environmental literacy. *Journal of Physics: Conference Series*, 1157(2). <https://doi.org/10.1088/1742-6596/1157/2/022030>
- Johnson, B., and Manoli, C. C. (2011). The 2-MEV scale in the US: A measure of children's environmental attitudes based on the theory of ecological attitude. *Journal of Environmental Education*, 42(2), 84–97. <https://doi.org/10.1080/00958964.2010.503716>
- Kobierska, H., Tarabula-Fiertak M., and Grodzińska-Jurczak M. (2007). Attitudes to environmental education in Poland. *Journal of Biological Education*, 42(1), 12–18. <https://doi.org/10.1080/00219266.2007.9656101>
- Kroufek, R., Janovec, J., and Chytrý, V. (2015). Pre-service primary teachers and their attitudes towards nature. In: Fleischmann, O., Seebauer, R., Zoglowek, H., and Aleksandrovich, M. [Eds.] *The Teaching Profession: New Challenges - New Identities*. Vienna: Lit Verlag GmbH & Co. KG.
- Liefländer, A. K. and Bogner, F. X. (2014). The effects of children's age and sex on acquiring proenvironmental attitudes through environmental education. *The Journal of Environmental Education*, 45(2), 105–117. <https://doi.org/10.1080/00958964.2013.875511>
- McBeth, W., and Volk, T. L. (2010). The National Environmental Literacy Project: A baseline study of middle grade students in the United States. *The Journal of Environmental Education*, 41(1), 55–67. <https://doi.org/10.1080/00958960903210031>
- NAAEE (2019). *K-12 Environmental Education: Guidelines for Excellence Executive Summary*. Washington DC: NAAEE. 16 s.
- Nastoulas, I., Marini, K., and Skanavis, C. (2017). *Middle School Students' Environmental Literacy Assessment in Thessaloniki, Greece*. Health and Environment Conference Proceedings. Hamdan Bin Mohammed Smart University, Dubai, 198–209.
- Osbaldiston, R., and Schott, J. P. (2012). Environmental Sustainability and Behavioral Science: Meta-Analysis of Proenvironmental Behavior Experiments. *Environment & Behavior*, 44(2), 257–299. <https://doi.org/10.1177/0013916511402673>
- Parry, J., and Allison, P. (Eds.). (2019). *Experiential Learning and Outdoor Education: Traditions of practice and philosophical perspectives* (1st ed.). Routledge. <https://doi.org/10.4324/9780429298806>
- Pereira, M., and Forster, P. (2015). The Relationship between Connectedness to Nature, Environmental Values and Pro-environmental Behaviours. *Reinvention: An International Journal of Undergraduate Research*, 8(2).
- Potočnik, K., Golob, N., and Sikošek, D. (2010). Ali program Ekošola prispeva k odgovornejšemu ravnanju učencev tretjega triletja? *Journal of Elementary Education*, 3(2/3), 47–62. <https://journals.um.si/index.php/education/article/view/274>
- Potyrala, 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.
- Ramsey, C. E., and Rickson, R. E. (1976). Environmental Knowledge and Attitudes. *The Journal of Environmental Education*, 8(1), 10–18. <https://doi.org/10.1080/00958964.1976.9941552>
- Roth, C. E. (1992). *Environmental literacy: Its roots, evolution, and directions in the 1990s*. Columbus: ERIC Clearinghouse for Science, Mathematics and Environmental Education.
- Schumm, M. F., and Bogner, F. X. (2016). How Environmental Attitudes Interact with Cognitive Learning in a Science Lesson Module. *Education Research International*, Article ID 6136527, 7 pages, <https://doi.org/10.1155/2016/6136527>
- Stoczowska, R. (2002). 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.
- Svobodová, S. (2020). Environmental literacy of pupils and its investigation in the Czech Republic. *Sociální pedagogika/Social Education*, 8(1), 88–104. <https://doi.org/10.7441/soced.2020.08.01.04>

- Svobodová, S., and Kroufek, R. (2018). Možnosti využití škály MSELS pro testování environmentální gramotnosti na základních školách v České republice. *Scientia in Education*, 9(2). <https://doi.org/10.14712/18047106.1210>
- Svobodová, S., and Chvál, M. (2019). *The Pilot Verification of the Authoring Research Tool for the Comprehensive Measurement of Environmental Literacy of ISCED Level 2 Pupils in the Czech Republic*. In INTED2019 Proceedings: 1947–1958, Valencia, Spain.
- Tavakol, M., and Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2, 53–55.
- Whitburn, J., Linklater, W., and Abrahamse, W. (2020). Meta-analysis of human connection to nature and proenvironmental behavior. *Conservation Biology*, 34(1), 180–193. <https://doi.org/10.1111/cobi.13381>

Author:

PhDr. Ing. Silvie Svobodová, Ph.D.

Faculty of Science, Purkyně University in Ústí Nad Labem; Department of Biology and Environmental Studies, and Charles University Faculty of Education, Prague, Czech Republic, e-mail: silviesvobodova74@seznam.cz

Fakulteta za naravoslovje, Univerza v Purkyně v Ústí Nad Labem, Oddelek za biologijo in okoljske študije in Karlova Univerza Pedagoška fakulteta, Praga, Češka republika, e-pošta: silviesvobodova74@seznam.cz