



Environmental Literacy of ISCED 2 Pupils in the Czech Republic and Slovakia

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ABSTRACT

Environmental literacy first emerged as a goal of environmental education in the 1960s and 1970s. The theory of environmental literacy assumes that an environmentally literate individual has adequate knowledge and attitudes and behaves in an environmentally friendly manner. Presented study focuses on the application of the modified version of the middle school environmental literacy survey research tool in the Central-European context. Its key objective is to identify the cognitive, affective, and behavioral dimensions of environmental literacy and the significance of the impact of specific demographic variables (gender, age, grade, and leisure activities), including comparative analysis between the Czech Republic and Slovakia. A statistically significant relationship was identified between affective and behavioral dimensions. All demographic variables, particularly pupil's leisure, have a significant effect. The differences between pupils of Czech and Slovak primary schools are only partial, probably because of the shared history of both countries.

Keywords: environmental literacy, ISCED 2, pupils, environmental education, MSELs

INTRODUCTION

The concept of "environmental education" has evolved dynamically over the decades, and its objectives were formally formulated for the first time at the First Intergovernmental Conference on Environmental Education in Tbilisi in 1977 (UNESCO, 1977). Definition of the field was formed among international institutions, the academic community, and non-governmental organizations in the narrow social, cultural, and political context of individual regions, thus relatively unevenly (Disinger, 2005).

The initial conception of environmental education, as a tool for shaping the necessary patterns of behavior resulting from environmental awareness, knowledge, attitudes, and skills, was to promote social goals in the field of nature conservation (UNESCO, 1977). This conception, representing the mainstream view, was later developed several times, defining the target levels of environmental education (Hungerford et al., 1980; Marcinkowski, 2005). Their structure was subject of experts' verification to identify other key variables. Some approaches were rejected, such as the KAB model based on the assumption of a linear relationship between knowledge, attitudes, and behavior (Ramsey & Rickson, 1976). While the concept of REB model (responsible environmental behavior), prefers to develop environmental sensitivity and skills of analysis and engagement in solving environmental problems, including beliefs about personal impact (Hungerford & Volk, 1990).

An important result of approach following the REB model are recommendation standards by the North American Association for Environmental Education (NAAEE), based on conducted research and on consensus

among environmental education experts. They represent not only the elaborated goals of environmental education, but also recommend specific ways of their implementation into the education process (NAAEE, 2010).

Czech and Slovak environmental education had been developing together until the 1990s. It was politically conditioned, and its implementation was mainly due to the non-formal education enthusiasts, and its theoretical side was reflected only minimally. Between the 1950s and 1970s, the foundations of contemporary environmental education can be found in "environmental conservation education". In the 1980s, it was replaced by "ecological education", aiming at the systematic integration of nature conservation issues into the educational system in the wider context (Medal, 2015). In the 1990s, both countries separated, including their education systems. In the Czech Republic, a key role in the field of environmental education took the so-called "ecological education centers", where the emphasis has been placed on the scientific dimension, knowledge of nature, understanding of environmental laws and acquiring desirable behavior patterns (Cincera, 2007).

The qualitative shift and changes in the official conception of environmental education in the Czech Republic since the beginning of the 21st century, whose current concept corresponds to generally accepted foreign approaches to the field, is evidence of a paradigmatic turn lasting over several years. The current state of the field in the Czech Republic can be considered relatively good mainly due to the strong embedding of environmental education in a formal and non-formal education, including relevant documents (Cincera & Johnson, 2013).

In Slovakia, the state of environmental education is assessed as unsatisfactory and unsystematic, with significant differences between the regions. In general, there is no sophisticated conception of the country environmental policy, because this topic is rather overlooked by the society. There is a lack of appropriate infrastructure, and the number of resources is insufficient. Cooperation between the formal and non-formal components of environmental education is weak (Medal, 2011).

In the official curriculum in both countries, environmental education is a cross-curricular theme, which is integrated into the relevant educational areas in connection with the school educational program (MSMT, 2017; MSVVS, 2015; Sucha et al., 2011).

Environmental Literacy

The main objectives and principles of environmental education have become the basis for defining environmental literacy (Roth, 1992; Simmons, 1995; Wilke, 1995), including tools for its evaluation (Wilke, 1995). Environmental literacy was mainly perceived as an essential and expected goal of environmental education (Hungerford & Tomera, 1977; Volk et al., 1984), its concept was not explicitly defined, and the term was interpreted and used in many different meanings. Later, Roth (1992) attempted to establish its definition in detail through the environmental education objectives, firstly set at the Tbilisi Conference. The current definition comes from NAAEE. This concept comprehensively includes all the environmental education framework objectives (Hollweg et al., 2011). It represents a relatively broad multidimensional delimitation, which can be summarized into three key dimensions, cognitive, affective, and behavioral. The authors of this paper also build upon the above stated definition of environmental literacy.

However, environmental literacy studies that respect this complexity are rather exceptions. One of the few studies outside of the U.S. is the one by Nastoulas et al. (2017). They investigated the environmental literacy of Greek middle school students using the MSELs instrument (McBeth & Volk, 2009). They found, among other things, that the students have an average knowledge on ecological subjects and that they are sensitive about the environment. Most studies focus on single dimensions or combinations of dimensions. Based on a review of existing research, Zelezny et al. (2000) found stability in gender differences. Women have stronger environmental attitudes and behaviors than men and are also more socially responsible. Ogunbode and Arnold (2012) did not confirm this fact for Nigerian respondents. For this region, they highlight occupation and education as strong factors influencing the elements of environmental literacy. Ogunbode (2013) in the same African region also documented the lower environmental attitudes of university students compared to other areas of the world. In a large study of American students, Bogner et al. (2015) documented a decline in attitudes towards nature conservation with age.

In the cognitive dimension of environmental literacy, the topics most often examined are those related to global issues, particularly climate change (Gul & Yesilyurt, 2011). The knowledge of university students is burdened with a number of misconceptions, among the most classic being the link between climate change and ozone depletion (Jeffries et al., 2001). Younger students often think that limiting nuclear power plants will lead to significant climate change mitigation (Bronven et al., 2004).

The lack of comprehensive research on the wide range of environmental literacy components in a large sample of respondents was one of the fundamental arguments for conducting national research on environmental literacy among high school students in the USA (The national environmental literacy project) (McBeth & Volk, 2009). For the purpose of the research, the middle school environmental literacy survey (MSELS) was developed (McBeth et al., 2008)—a scale that covers all dimensions of environmental literacy and is suitable for ISCED 2 (UNESCO, 2011) students. It is a set of tests and questionnaires consisting of 75 items. It is focused on environmental knowledge (II. Ecological foundations), attitudes (III. How you think about the environment), commitment to pro-environmental behavior and declared behavior (IV. What you do about the environment), sensitivity (V. You and environmental sensitivity, VI. How you feel about the environment), and the ability to analyze and then effectively solve environmental problems (VII. Issue identification, issue analysis and action planning). The tool was successfully validated mainly in the American environment (McBeth et al., 2008, 2011; McBeth & Volk, 2009; Stevenson et al., 2013, 2014), also in Greece (Nastoulas et al., 2017) and the Czech Republic (Svobodova 2020; Svobodova & Chval, 2022).

Study Objectives and Research Questions

This study deals with the application of the modified version of MSELS research tool (McBeth et al., 2008) to the ISCED level 2 pupils in the Czech Republic and Slovakia. In Slovakia, ISCED 2 starts with the fifth year of school, and in order to maintain the same age range in both countries, data were collected from 6th to 9th grade of lower secondary school and corresponding years of multi-year grammar schools. Its main objective is to identify the cognitive, affective, and behavioral dimensions of environmental literacy, and to identify the significance of the impact of specific variables (gender, age, grade, and leisure activities) on its level, and to compare the results between the two countries.

Answers to the following research questions are sought:

1. What is the relationship between the cognitive, affective, and behavioral dimensions of environmental literacy of ISCED 2 pupils in the Czech Republic and Slovakia?
2. What variables (gender, age, grade, and leisure activities) influence the cognitive, affective, and behavioral dimension of environmental literacy of ISCED 2 pupils in the Czech Republic and Slovakia?
3. What are the differences in environmental literacy and between the variables that affect it in ISCED 2 pupils of the Czech Republic and Slovakia?

For the first two questions we look for an answer to the whole set of respondents at the same time, while for the third question we make an international comparison between the two countries.

METHODOLOGY

Sampling

Four secondary schools in the Czech Republic (n=344) participated in the survey with gender ratio being 182 girls and 162 boys, and one in Slovakia (n=92) with 44 girls and 48 boys. Schools were selected by convenience sampling, and all students at the school from grades 6 to 9 participated in data collection (n=436, with 226 girls and 210 boys).

The paper questionnaires were distributed to individual schools in person by the authors of the research or via a contact person, a teacher familiar with the procedure, requirements, and objectives of the research.

Questionnaire

For the purpose of this study, the MSELS research tool (McBeth et al., 2008) was translated and adapted in the context of the social environment of Czech and Slovak pupils. The part of the tool verifying the skills for analysis and subsequent effective solution of environmental problems (VII. Issue identification, issue analysis

Table 1. Overview of the Spearman correlations among tool's scales (n=436)

Tool's scales	Knowledge	Attitudes	Sensitivity	Behavior
Knowledge		0.15	-0.01	0.12
Attitudes	0.15		0.38	0.57
Sensitivity	-0.01	0.38		0.48
Behavior	0.12	0.57	0.48	

Note. Statistically significant values are **bold** ($p < 0.05$)

and action planning) was removed from the tool, because the model situations solved are placed in the context of American society. A modified version of MSELs is a questionnaire with 59 items divided into six sections.

The first part consists of items identifying the pupils' demographic background: gender, age, grade, and the way of spending leisure time (e.g., outdoor activities, computer, hobbies, or sport). Next 17 items focus on environmental knowledge (cognitive dimension), they always have one correct answer out of four options. The third part examines environmental attitudes (affective dimension), the fourth one examines environmental behavior (behavioral dimension) and the fifth focuses on environmental sensitivity (affective dimension). Two final items analyze the pupils' relationship to nature and the environment (affective dimension) through five-point Likert scale. Responses were given points, 5 points for totally positive and 1 point for totally negative response (opposite in reversed items). Reliability of the whole instrument and its subscales reached acceptable values: MSELs ($\alpha=0.88$), knowledge ($\alpha=0.76$), attitudes ($\alpha=0.77$), behavior ($\alpha=0.75$), sensitivity ($\alpha=0.81$). Thus, the individual scales can be considered sufficiently accurate (Tavakol & Denick, 2011).

Data analysis

The obtained data were analyzed via Statistica 12 (Statsoft, 2018). For the MSELs tool subscales attitudes (III.), behavior (IV.), and sensitivity (V.), data do not show the normal distribution, therefore non-parametric statistical methods were used.

The relationship between the individual dimensions of environmental literacy was identified using Spearman correlations, and the influence of selected variables was subsequently analyzed by non-parametric statistical methods, namely the Mann-Whitney U test for the gender, and Kruskal-Wallis ANOVA including post-hoc analysis for other variables.

RESULTS

The Relationship Between the Dimensions of Environmental Literacy

The ratio between the dimensions of environmental literacy was determined by calculating mutual Spearman correlations for all respondents (CZE and SVK together) and was identified as significant (**Table 1**). The cognitive dimension proved to be the weakest in relation to the other dimensions, while affective and behavioral dimensions show moderate relation.

Influence of Demographic Variables

In the case of gender, the impact was identified as statistically significant, with higher values achieved by girls, for subscales attitudes ($Med_{female}=46.53$; $Med_{male}=43.52$; $z=3.93$; $p < 0.01$) and behavior ($Med_{female}=40.48$; $Med_{male}=37.42$; $z=3.58$; $p < 0.01$).

Significant impact of age was proven in all the subscales (attitudes: $H=12.92$, $p=0.005$; sensitivity: $H=16.33$, $p=0.001$; behavior: $H=36.87$, $p < 0.001$) except knowledge, where null hypothesis cannot be rejected. Subsequent post-hoc analysis showed significant differences between 12- and 14-year-olds (attitudes: $Med_{12}=46.05$, $Med_{14}=42.05$, $p=0.02$; behavior: $Med_{12}=41.84$, $Med_{14}=33.94$, $p < 0.001$; sensitivity: $Med_{12}=32.72$, $Med_{14}=27.90$, $p < 0.001$), in subscale of behavior also between 12- and 15-year-olds ($Med_{12}=41.84$, $Med_{15}=35.91$, $p=0.03$). Younger pupils always reached higher scores.

Variable grade has a statistically significant effect on the results of all scales, including knowledge (knowledge: $H=11.51$, $p=0.009$; attitudes: $H=10.83$, $p=0.013$; sensitivity: $H=8.30$, $p=0.04$; acting: $H=32.97$,

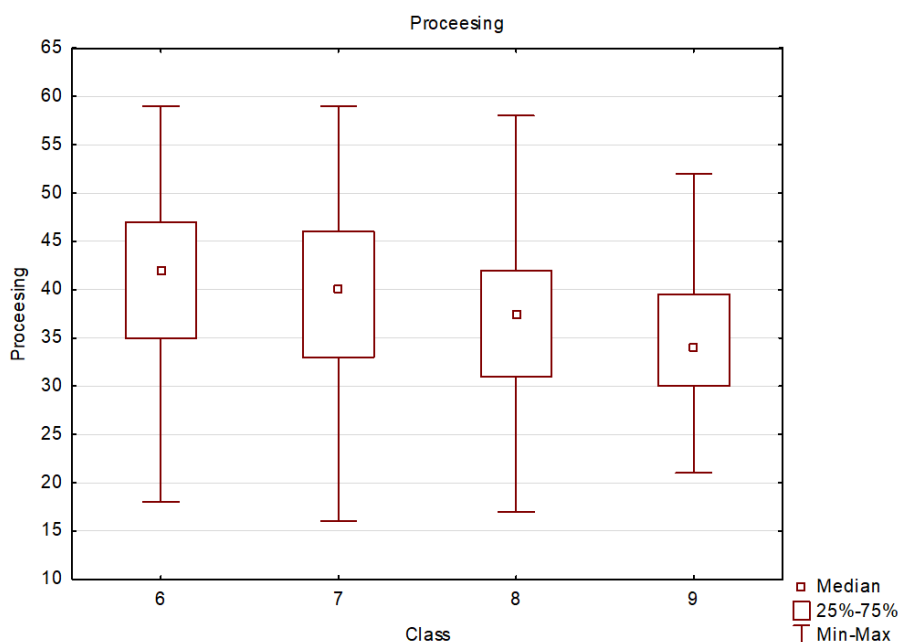


Figure 1. The relationship between the scale of *behavior* and the variable grade

$p < 0.001$). For the scale of attitudes, we reject the null hypothesis when comparing the seventh and ninth grades ($Med_7 = 45.71$, $Med_9 = 41.88$, $p = 0.01$), for the sensitivity scale between the sixth and ninth grades ($Med_6 = 32.88$, $Med_9 = 29.75$, $p = 0.048$) and for the behavior scale by more combinations ($Med_6 = 42.16$, $Med_8 = 37.43$, $p = 0.004$; $Med_6 = 42.16$, $Med_9 = 34.02$, $p < 0.001$; $Med_7 = 39.94$, $Med_9 = 34.02$, $p < 0.001$). There is always a decrease in the observed values with increasing grade, which is illustrated in [Figure 1](#). The knowledge scale proves a statistically significant difference only between the sixth and seventh grade ($Med_6 = 10.00$, $Med_7 = 10.97$, $p = 0.01$).

Leisure activity has proved to be the most important variable, having an impact on all scales of the instrument, with the highest values being achieved by those respondents who prefer to stay outdoors rather than those who spend their free time by the computer. A significant difference was also identified between the two leisure activities through post hoc analysis. In comparison with other activities, the outdoor stay was the strongest, and significantly differ from three of them (knowledge: $Med_{stay\ in\ nature} = 10.95$, $Med_{sport} = 0.00$, $p = 0.002$; attitudes: $Med_{stay\ in\ nature} = 46.85$, $Med_{computer} = 40.80$, $p < 0.001$; sensitivity: $Med_{stay\ in\ nature} = 35.00$, $Med_{computer} = 27.50$, $Med_{stay\ in\ nature} = 35.00$, $Med_{hobbies} = 31.00$, $p < 0.001$; and behavior: $Med_{stay\ in\ nature} = 42.13$, $Med_{computer} = 33.60$, $p < 0.001$).

Differences in Environmental Literacy Between the Czech Republic and Slovakia

The effect of the country did not appear to be statistically significant in any of the sub-scales, however, there were significant differences in gender and age among respondents from individual countries. In the case of gender, the effect of the country manifested in the scales of attitudes, sensitivity, and behavior.

Unlike Slovak girls, girls from the Czech Republic achieved higher values in all scales. On the contrary, the opposite trend was registered in boys. The results of boys from Slovakia exceeded the results of boys from the Czech Republic, as shown in [Table 2](#).

In the knowledge scale, the respondents from the Czech Republic showed an increase in score with growing age from 12th to 14th year. On the contrary, the level of knowledge decreases with age in the respondents from Slovakia, most notably from the 12th to the 13th year ([Figure 2](#)).

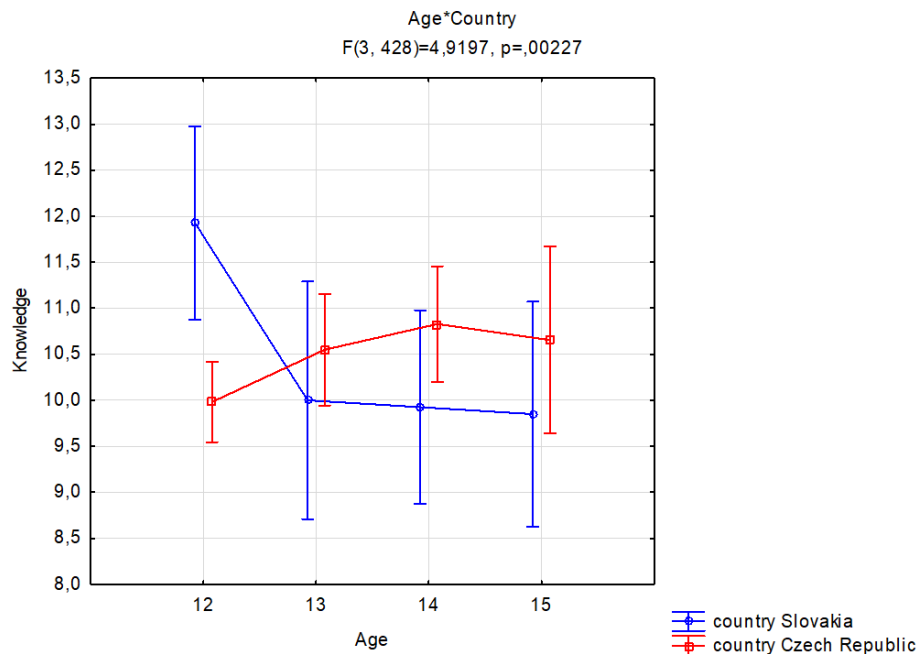
DISCUSSION

The relationship among the individual dimensions of environmental literacy was identified as significant and moderately strong, mainly between affective and behavioral dimensions, the influence of the cognitive dimension proved to be very weak. Similar findings, when applying the same MSELs research tool, were also

Table 2. Overview of median values of girls and boys of both countries in individual scales

Tool's scales	Female		Male		F	p
	CZE	SVK	CZE	SVK		
Attitudes	46.10	42.93	41.99	43.29	5.75	p=0.017
Sensitivity	32.68	29.91	30.34	32.40	7.31	p=0.007
Behavior	39.86	39.43	35.81	39.69	4.65	p=0.032

Note. CZE: Czech Republic & SVK: Slovak Republic

**Figure 2.** A figure on top

made by Nastoulas et al. (2017). This supports the generally accepted rejection of the KAB model (Ramsey & Rickson, 1976). The cognitive dimension of environmental literacy does not significantly affect the affective (attitude) or behavioral dimensions. These two dimensions correlate moderately in the Czech-Slovak environment, which confirms the conclusions other researchers have drawn on the influence of the affective component on the behavior (Bamberg & Möser, 2007; Heimlich & Ardoin, 2008; Hines et al., 1987; Marcinkowski, 1991).

The results are consistent with the findings of a recent representative survey of environmental literacy among Czech teenagers (Kroufek & Cincera, 2021). Gender, age, grade, and leisure activities showed statistically significant influence. Gender affected mainly attitudes and environmentally responsible behavior, with girls reaching higher scores. Many studies have shown that women are more receptive to environmental problems than men. They express greater concern about potential environmental risks (Davidson & Freudenberg, 1996; Tindall et al., 2003; van Liere & Dunlap, 1980). Women, unlike men, who are more associated with a rational and abstract culture, are emotionally related to nature (Wihlborg & Skill, 2004). Identical findings are reported by studies focused on the ecofeminism (Godfrey, 2005; Leach, 2007). Women environmental activists have played a key role in creating and disseminating environmental awareness and protection of the environment (Unger, 2008; Zelezny & Bailey, 2006).

Age proved to be essential in attitudes, behavior, and sensitivity, as scores decrease with increasing age (similarly with grade). Identical findings, regarding significant negative correlation of age with the affective dimension of environmental literacy, were made by Bogner et al. (2015), Liefländer & Bogner (2014), Nastoulas et al. (2017), or Stevenson et al. (2013, 2014). Similarly, respondents from lower grades achieved higher scores in attitudes and sensitivity in the national environmental literacy project in the USA (McBeth & Volk, 2009; McBeth et al., 2011).

Significant relationship was identified between all the scales of the research instrument and the ways respondents spend their leisure. The activity "stay in nature" was the most positive and the lowest scores were

recorded by respondents who spend their leisure especially by the computer. Positive impact of regular outdoor activities on the behavioral dimension of environmental literacy was also confirmed by Kroufek et al. (2016, 2021), Geng et al. (2015), or Hsu and Roth (1998).

The comparative analysis of the Czech Republic and Slovakia shows that there is no demonstrable difference in the values of environmental literacy between pupils from individual countries. Significant differences between the two countries were found only in gender and age. The level of attitudes, sensitivity, and behavior of girls from the Czech Republic was higher than girls from the Slovak Republic, whereas the boys showed reversed results. Opposite tendencies between the countries were also reflected in the relation of age and knowledge. In the Czech Republic, the knowledge correlated positively with age, unlike Slovakia, where negative correlation was recorded.

The minimal differences in the results between the two countries can be explained mainly by the common historical development, which lasted almost 74 years, from 1918 to 1992. The curricular documents of both education systems correspond in many ways and in the period of the Czechoslovakia, education in both countries was realized within the framework of the common educational policy. Also, the influence of the environmental centers on the current form of environmental education is similarly important in both countries. The absence of differences between the Czech Republic and Slovakia has also appeared in other comparisons of different cultural processes (Saffa et al., 2021), probably because of the historical, cultural, and political similarities between the two countries.

Limits

The authors are aware of the limits of the study, which comes mainly from the size of the sample of respondents and its selection. The results presented should be seen in the light of these limits.

CONCLUSION

This paper presents the results of an analysis of the application of the MSELs research tool (McBeth et al., 2008) for ISCED 2 pupils in the Czech Republic and Slovakia.

The relationship between the affective and the behavioral dimensions of environmental literacy proved to be significant, moderate, and positive. The relationship with the cognitive dimension seemed negligible. All tested demographic variables (gender, age, grade, and leisure activities) can be considered as important determinants of environmental literacy. The differences between the Czech and Slovak pupils of the lower level of secondary schools are apparent in selected aspects of environmental literacy, mainly in the context of respondents' gender.

Choosing activities that appeal more to boys may be recommended for environmental education practice in schools. In order to successfully achieve changes in students' pro-environmental behavior, it is necessary to focus teachers' attention on values and attitudes, as simply increasing knowledge has little effect. Schools should also cooperate more with leisure centers, as the impact of leisure on pro-environmental behavior is significant.

A modified version of MSELs tool can be recommended for testing environmental literacy of ISCED level 2 pupils in the Czech Republic and Slovakia. It can be used to evaluate the effectiveness of environmental education in schools.

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